2010

# NRL FACT BOOK


"The Navy's Corporate Laboratory"

The NRL Fact Book is a reference source for information about the Naval Research Laboratory (NRL). It is updated and placed on NRL's Web site (http://www.nrl.navy.mil/) annually. It is printed every other year. To provide additional information to the reader, a point of contact is listed for each activity.

NRL has a continuing need for physical scientists, mathematicians, engineers, and support personnel. Vacancies are filled without regard to age, race, creed, sex, or national origin. Information concerning current vacancies is furnished on request. Address all such inquiries to:

Human Resources Office
Personnel Operations Branch (Code 1810)
Naval Research Laboratory
Washington, DC 20375-5320

**NRL's URL: http://www.nrl.navy.mil/**

## Quick Reference Telephone Numbers

| | NRL WASHINGTON | NRL-SSC | NRL-MONTEREY | NRL CBD | NRL FSD Patuxent River |
|---|---|---|---|---|---|
| Hotline | (202) 767-6543 | (202) 767-6543 | (202) 767-6543 | (202) 767-6543 | (202) 767-6543 |
| Personnel Locator | (202) 767-3200 | (228) 688-3390 | (831) 656-4763 | (410) 257-4000 | (301) 342-3751 |
| DSN | 297- or 754- | 828 | 878 | — | 342 |
| Direct-in-Dialing | 767- or 404- | 688 | 656 | 257 | 342 |
| Public Affairs | (202) 767-2541 | (228) 688-5328 | (202) 767-2541 | — | (202) 767-2541 |

Additional telephone numbers are listed on pages 138 and 139.

# NRL FACT BOOK

NAVAL RESEARCH LABORATORY
WASHINGTON, DC 20375-5320

# Contents

# Introduction to the Naval Research Laboratory

## Mission

**To conduct a broadly based multidisciplinary program of scientific research and advanced technological development directed toward maritime applications of new and improved materials, techniques, equipment, systems, and ocean, atmospheric, and space sciences and related technologies.**

**The Naval Research Laboratory**

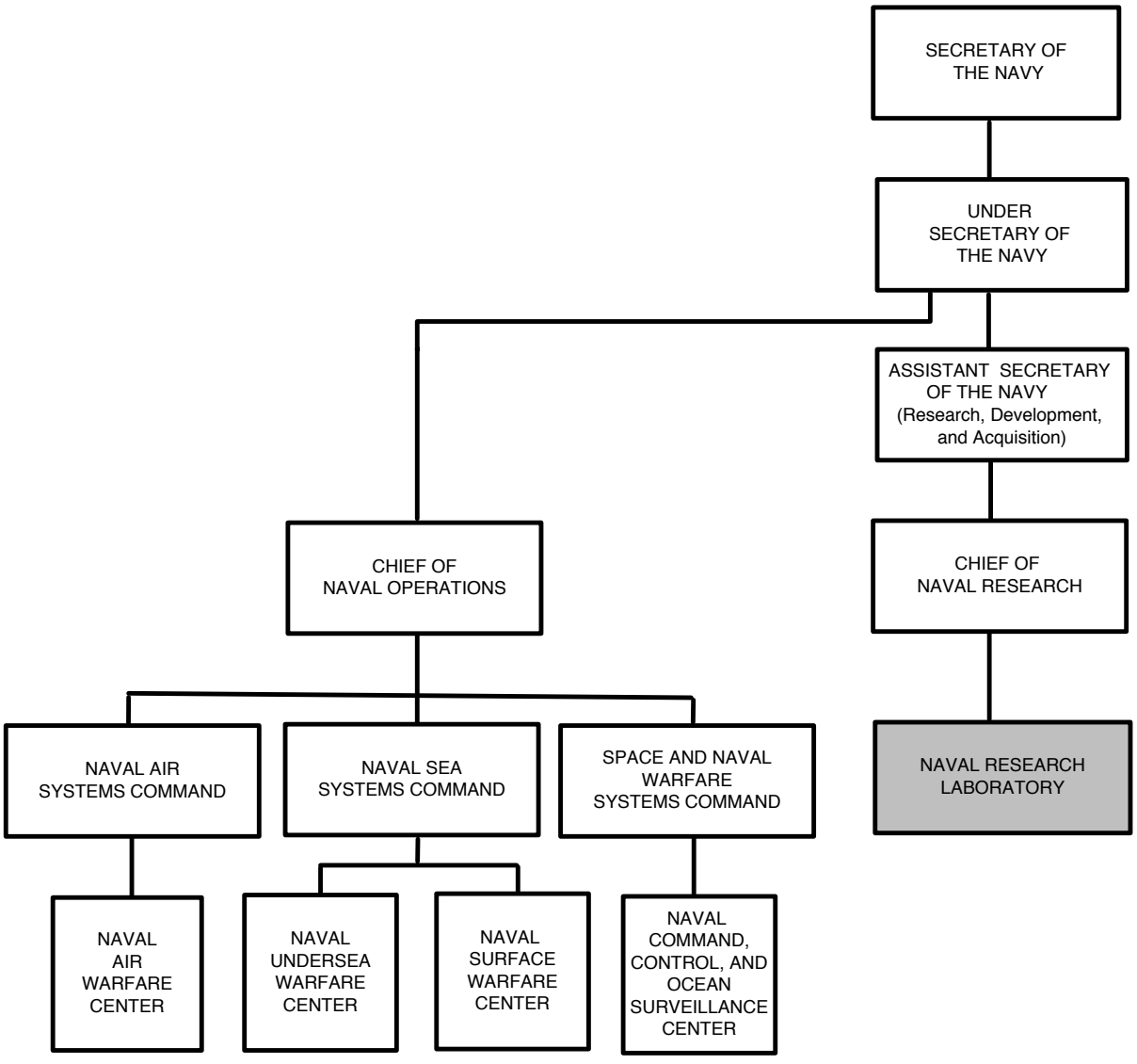
- **Provides primary in-house research for the physical, engineering, space, and environmental sciences;**
- **Provides broadly based exploratory and advanced development programs in response to identified and anticipated Navy and Marine Corps needs;**
- **Provides broad multidisciplinary support to the Naval Warfare Centers;**
- **Provides space and space systems technology development and support; and**
- **Assumes responsibility as the Navy's corporate laboratory.**

The Naval Research Laboratory is located in Washington, DC, on the east bank of the Potomac River.

The NRL Marine Meteorology Division is located in Monterey, California (NRL-MRY).

The Naval Research Laboratory Detachment is located at Stennis Space Center, Bay St. Louis, Mississippi (NRL-SSC).


DEPARTMENT OF THE NAVY
UNITED STATES OF AMERICA


SECRETARY OF THE NAVY
UNDER SECRETARY OF THE NAVY
ASSISTANT SECRETARY OF THE NAVY (Research, Development, and Acquisition)
CHIEF OF NAVAL OPERATIONS
CHIEF OF NAVAL RESEARCH
NAVAL AIR SYSTEMS COMMAND
NAVAL SEA SYSTEMS COMMAND
SPACE AND NAVAL WARFARE SYSTEMS COMMAND
NAVAL RESEARCH LABORATORY
NAVAL AIR WARFARE CENTER
NAVAL UNDERSEA WARFARE CENTER
NAVAL SURFACE WARFARE CENTER
NAVAL COMMAND, CONTROL, AND OCEAN SURVEILLANCE CENTER


# The Naval Research Laboratory in the Department of the Navy

The Naval Research Laboratory is the Department of the Navy's corporate laboratory; it is under the command of the Chief of Naval Research. As the corporate laboratory of the Navy, NRL is the principal in-house component in the Office of Naval Research's (ONR) effort to meet its science and technology responsibilities.

NRL has had a long and fruitful relationship with industry as a collaborator, contractor, and most recently in Cooperative Research and Development Agreements (CRADAs). NRL values this linkage and continues to develop it.

NRL is an important link in the Navy Research, Development, and Acquisition (RD&A) chain. Through NRL, the Navy has direct ties with sources of fundamental ideas in industry and the academic community throughout the world and provides an effective coupling point to the R&D chain for ONR.

# NRL Functional Organization

**COMMANDING OFFICER**
Code 1000
CAPT P.C. Stewart, USN

**DIRECTOR OF RESEARCH**
Code 1001
Dr. J.A. Montgomery

**CHIEF STAFF OFFICER**
Code 1002
CAPT T.B. Brewer, USN

- Security
- Scientific Development Squadron One (VXS-1)
- MILOPS
- MILPERS
- Management Control and Review
- Inspector General

**HUMAN RESOURCES OFFICE**
Code 1800
Ms. C.L. Downing
(Acting)

- Equal Employment Opportunity and Manpower
- Staffing and Classification
- Employee Development
- Employee Relations
- Wellness
- Personnel Demonstration Project
- Compensation

**BUSINESS OPERATIONS**
Code 3000
Mr. D.K. Therning

- Contracts
- Financial Management
- Supply and Information Services
- Research and Development Services
- Chesapeake Bay Section
- Management Information Systems
- Safety

**MATERIALS SCIENCE AND COMPONENT TECHNOLOGY**
Code 6000
Dr. B.B. Rath

- Chemistry
- Materials Science and Technology
- Laboratory for Computational Physics and Fluid Dynamics
- Plasma Physics
- Electronics Science and Technology
- Center for Bio/Molecular Science and Engineering

**NAVAL CENTER FOR SPACE TECHNOLOGY**
Code 8000
Mr. P.G. Wilhelm

- Space Systems Development
- Spacecraft Engineering

**SYSTEMS**
Code 5000
Dr. G.M. Borsuk

- Radar
- Information Technology
- Optical Sciences
- Tactical Electronic Warfare

**OCEAN AND ATMOSPHERIC SCIENCE AND TECHNOLOGY**
Code 7000
Dr. E.R. Franchi

- Research Support Services
- Acoustics
- Remote Sensing
- Oceanography
- Marine Geosciences
- Marine Meteorology
- Space Science

# Current Research

The following areas represent broad fields of NRL research. Under each, more specific topics that are being investigated for the benefit of the Navy and other sponsoring organizations are listed. Some details of this work are given in the *NRL Review*, published annually. More specific details are published in reports on individual projects provided to sponsors and/or presented as papers for professional societies or their journals.

## Advanced Radio, Optical, and IR Sensors

- Advanced optical sensors
- EM/EO/meteorological/oceanographic sensors
- Satellite meteorology
- Precise space tracking
- Radio/infrared astronomy
- Infrared sensors and phenomenology
- UV sensors and middle atmosphere research
- Image processing
- VLBI/astrometry
- Optical interferometry
- Imaging spectrometry
- Liquid crystal technology

## Computer Science and Artificial Intelligence

- Standard computer hardware, development environments, operating systems, and run-time support software
- Methods of specifying, developing, documenting, and maintaining software
- Human-computer interaction
- Intelligent systems for resource allocation, signal identification, operational planning, target classification, and robotics
- Parallel scientific libraries
- Algorithms for massively parallel systems
- Digital progressive HDTV for scientific visualization
- Adaptive systems: software and devices
- Advanced computer networking
- Simulation management software for networked high performance computers
- Interactive 3D visualization tools and applications
- Distributed modeling and simulation (e.g., HLA and FOM development)
- Real-time parallel processing
- Scalable, parallel computing
- Processing graph method for parallel processing
- Teraflop scalable shared memory, massively parallel computer architectures

## Directed Energy Technology

- High-energy lasers
- Laser propagation
- Solid-state and fiber lasers
- High-power microwave sources
- RAM accelerators
- Pulse detonation engines
- Charged-particle devices
- Pulse power
- DE effects

## Electronic Electro-optical Device Technology

- Integrated optics
- Radiation-hardened electronics
- Nanotechnology
- Microelectronics
- Microwave and MM wave technology
- Hydrogen masers for GPS
- Aperture syntheses
- Electric field coupling
- Vacuum electronics
- Focal plane arrays
- Infrared sensors
- Radiation effects and satellite survivability
- Molecular engineering

## Electronic Warfare

- EW/C2W/IW systems and technology
- COMINT/SIGINT technology
- EW decision aids and planning/control systems
- Intercept receivers, signal processing, and identification systems
- Passive direction finders
- Decoys and offboard CM (RF and IR)
- Expendable autonomous vehicles/UAVs
- Repeaters/jammers and EO/IR active countermeasures and techniques
- Platform signature measurement and management
- Threat and EW systems computer modeling and simulations
- Visualization
- Hardware-in-the-loop and flyable ASM simulators
- Missile warning infrared countermeasures
- RF environment simulators
- EO/IR multispectral/hyperspectral surveillance

## Enhanced Maintainability, Reliability, and Survivability Technology

- Coatings
- Friction/wear reduction
- Water additives and cleaners
- Fire safety
- Laser hardening
- Satellite survivability
- Corrosion control
- Automation for reduced manning
- Radiation effects

Mobility fuels
Chemical and biological sensors
Environmental compliance

## Environmental Effects on Naval Systems

Meteorological effects on communications
Meteorological effects on weapons, sensors, and platform performance
Air quality in confined spaces
Electromagnetic background in space
Solar and geomagnetic activity
Magnetospheric and space plasma effects
Nonlinear science
Ionospheric behavior
Oceanographic effects on weapons, sensors, and platforms
EM, EO, and acoustic system performance/optimization
Environmental hazard assessment
Contaminant transport
Biosensors
Microbially induced corrosion

## Imaging Research/Systems

Remotely sensed signatures analysis
Real-time signal and image processing algorithms/systems
Image data compression methodology
Image fusion
Automatic target recognition
Scene/sensor noise characterization
Image enhancement/noise reduction
Scene classification techniques
Radar and laser imaging systems studies
Coherent/incoherent imaging sensor exploitation
Remote sensing simulation
Hyperspectral imaging
Microwave polarimetry

## Information Technology

High-performance, all-optical networking
Antijam communication links
Next-generation, signaled optical network architectures
Integrated voice and data
Information security (INFOSEC)
Voice processing
High performance computing
High performance communications
Requirement specification and analysis
Real-time computing
Wireless mobile networking
Natural environments for distributed simulation
Collaborative engineering environments
Information filtering and fusion
Integrated internet protocol (IP) and asynchronous transfer mode (ATM) multicasting
Reliable multicasting
Wireless networking with directional antennas
Sensor networking
Communication network simulation
Bandwidth management (quality of service)
High assurance software
Distributed network-based battle management
High performance computing supporting uniform and nonuniform memory access with single and multithreaded architectures
Distributed, secure, and mobile information infrastructures
Virtual engineering
Simulation-based virtual reality
Advanced distributed simulation
High-end, progressive HDTV imagery processing and distribution
Defensive information warfare
Virtual reality/mobile augmented reality
Motion adaptation and vestibular research
3D multimodal interaction
Model integration (physical, environmental, biological, psychological) for simulation
Synthetic natural environments for distributed simulation
Command decision support
Data fusion

## Marine Geosciences

Marine seismology, including propagation and noise measurement
Geoacoustic modeling in support of acoustic performance prediction
Geomagnetic modeling in support of nonacoustic system performance prediction
Static potential field measurement and analysis (gravity and magnetic) in support of navigation and geodesy
Geotechnology/sediment dynamics affecting mine warfare and mine countermeasures
Foreshore sediment transport
Geospatial information, including advanced seafloor mapping, imaging systems, and innovative object-oriented digital mapping models, techniques, and databases

## Materials

Superconductivity
Magnetism
Biological materials
Materials processing
Advanced alloy systems
Solid free-form fabrication
Environmental effects
Energetic materials/explosives
Aerogels and underdense materials
Nanoscale materials
Nondestructive evaluation
Ceramics and composite materials
Thin film synthesis and processing
Electronic and piezoelectric ceramics

Thermoelectric materials
Active materials and smart structures
Computational material science
Paints and coatings
Flammability
Chemical/biological materials
Spintronic materials and half metals
Biomimetic materials
Multifunctional materials

## Meteorology

Global, theater, tactical-scale, and on-scene numerical weather prediction
Data assimilation and physical initialization
Atmospheric predictability and adaptive observations
Adjoint applications
Marine boundary layer characterization
Air/sea interaction; process studies
Coupled air/ocean/land model development
Tropical cyclone forecasting aids
Satellite data interpretation and application
Aerosol transport modeling
Meteorological applications of artificial intelligence and expert systems
On-scene environmental support system development/nowcasting
Tactical database development and applications
Meteorological tactical decision aids
Meteorological simulation and visualization

## Ocean Acoustics

Underwater acoustics, including propagation, noise, and reverberation
Fiber-optic acoustic sensor development
Deep ocean and shallow water environmental acoustic characterization
Undersea warfare system performance modeling, unifying the environment, acoustics, and signal processing
Target reflection, diffraction, and scattering
Acoustic simulations
Tactical decision aids
Sonar transducers
Dynamic ocean acoustic modeling

## Oceanography

Oceanographic instrumentation
Open ocean, littoral, polar, and nearshore oceanographic forecasting
Shallow water oceanographic effects on operations
Modeling, sensors, and data fusion
Bio-optical and fine-scale physical processes
Oceanographic simulation and visualization
Coastal scene generation
Waves, tides, and surf prediction
Coupled model development
Coastal ocean characterization
Oceanographic decision aids
Global, theater, and tactical scale modeling
Remote sensing of oceanographic parameters
Satellite image analysis

## Space Systems and Technology

Space systems architectures and requirements
Advanced payloads and optical communications
Controllers, processors, signal processing, and VLSI
Precision orbit estimation
Onboard autonomous navigation
Satellite ground station engineering and implementation
Tactical communication systems
Spacecraft antenna systems
Launch and on-orbit support
Precise Time and Time Interval (PTTI) technology
Atomic time/frequency standards/instrumentation
Passive and active ranging techniques
Design, fabrication, and testing of spacecraft and hardware
Structural and thermal analysis
Attitude determination and control systems
Reaction control
Propulsion systems
Navigation, tracking, and orbit dynamics
Spaceborne robotics applications

## Surveillance and Sensor Technology

Point defense technology
Imaging radars
Surveillance radars
Multifunction RF systems
High-power millimeter-wave radar
Target classification/identification
Airborne geophysical studies
Fiber-optic sensor technology
Undersea target detection/classification
EO/IR multispectral/hyperspectral detection and classification
Sonar transducers
Electromagnetic sensors—gamma ray to RF wavelengths
SQUID for magnetic field detection
Low observables technology
Ultrawideband technology
Interferometric imagery
Microsensor system
Digital framing reconnaissance canvas
Biologically based sensors
Digital radars and processors

## Undersea Technology

Autonomous vehicles
Bathymetric technology
Anechoic coatings
Acoustic holography
Unmanned undersea vehicle dynamics
Weapons launch

# Major Research Capabilities and Facilities
## (Listed alphabetically by organizational unit)

## Acoustics Division (Code 7100)

- Laboratory Measurements
  - One million gallon, vibration-isolated underwater acoustic holographic/3D laser vibrometer facility for studying structural acoustic phenomena.
  - Large, sandy-bottom, acoustic holographic pool facility for investigating echo characteristics of underwater buried/near bottom targets and sediment acoustics.
  - In-air structural acoustics facility with high spatial density near field acoustic holography and 3D laser vibrometry for diagnosing large structures, including aircraft interiors and rocket payload fairings.
  - Salt water acoustic tank (20-ft by 20 ft by 10 ft deep) with environmental control and substantial optical access for studying the acoustics of bubbly media, acoustic metamaterials, and laser induced sound.
  - Micro-Nanostructure Dynamics Laboratory to study the structural dynamics and performance of high Q oscillators and other micro-mechanical systems using laser Doppler vibrometers, super resolution near field scanning optical microscope, and low temperature calorimeter.
  - Model Fabrication Laboratory to fabricate rough topographical surfaces in various materials for acoustic scattering and propagation studies and measurements.
  - Sonomagnetic Laboratory with doubly insulated Faraday cage for conducting experiments to measure weak electromagnetic fields generate by mechanical/acoustic vibrations of a conducting medium in an arbitrary magnetic field.
- Sea-Going Assets
  - Acoustic Arrays (Towed/Moored/Suspended)
  - 64 Channel broadband source-receiver array with time-reversal mirror functionality over a frequency band of 500-3500 Hz.
  - High powered sound sources and source arrays
  - Autonomous acoustic sources
  - Acoustic communications array and data acquisition buoy
  - Portable, ocean-deployable synthetic aperture acoustic measurement system (100 meter rail with precise positioning)
  - Containerized, sea going multichannel data acquisition system
  - High speed, maneuverable towed body with MK-50 and synthetic aperture sonars to measure high frequency scattering and coherence

## Center for Bio/Molecular Science and Engineering (Code 6900)

- Optical equipment
  - Confocal Microscope
  - Raman Microscope
  - UV-Visible Absorption Spectrophotometers
  - Transmission Electron Microscope
  - Scanning Electron Microscope
  - Confocal Microscope
  - Microscope/AFM
- Analytical instruments
  - Gas Chromatography Mass Spectrometer
  - HPLC
  - LC/MS/MS System
  - FluroMax-3 Spectrofluorometer
- General facilities
  - X-Ray Scattering
  - Cold room for storage and preparation
  - High-speed ultracentrifuges
  - Inert atmosphere dry box
  - NMR
  - FTIR
  - Ellipsometer
  - Dynamic Mechanical Analyzer
  - Differential scanning Calorimeter
  - Circular Dichroism
  - Minimill Injection Mold Machine
  - Multi Rf Centrifuge
  - Perkin Elmer BioChip Arrayer I
  - Freeze Dry System
  - Affymetrix Gene Chip system
  - Surface Plasmon Resonance (SPR)
  - Isothermal Calorimeter

## Chemistry Division (Code 6100)

- Synthesis/processing facilities
  - Paint formulation and coating
  - Functional polymers/elastomers
  - Langmuir-Blodgett film
  - Surface cleaning
  - Thin film deposition/etching with in situ control
- Marine Corrosion Facility (at Key West, FL)
- Fire/Damage Control Test Facility (at Mobile, AL)
- Characterization facilities
  - General purpose chemical analysis/trace analysis
  - Surface diagnostics
  - Nanometer scale composition/structure/properties
  - Magnetic resonance NDI
  - Tribology
  - Polymer structure/function
- Special purpose capability
  - Environmental monitoring/remediation
  - Combustion and fire research
  - Alternate and petroleum-derived fuels
- Simulation/modeling
- Synchrotron radiation beam lines (at NSLS, Brookhaven, NY)
- Pressurized test chambers (small, medium, large) (at CBD, MD)

## Electronics Science and Technology Division (Code 6800)

- Nano- and microelectronics characterization and processing facilities
- Electron-beam nanowriter
- High-resolution transmission electron microscope
- Scanning tunneling microscopy and electro-optical analysis
- Crystal growing facilities including bulk growth, molecular beam epitaxy, and organometallic chemical vapor deposition
- Optical and electrical characterization of materials
- Electronic testing and analysis facilities
- Cathode Fabrication and Characterization Laboratory
- Millimeter Wave Vaccum Electronics Fabrication Facility
- Femtosecond laser facility
- Solar cell characterization facility
- Power electronics materials characterization and device processing facilities

## Information Technology Division (Code 5500)

- Extended Spectrum Experimentation Laboratory
- Robotics & Autonomous Systems Laboratory
- Immersive Simulation Laboratory
- Warfighter Human-Systems Integration Laboratory
- Audio Laboratory
- Mobile and Dynamic Network Laboratory
- Integrated Communications Technology Test Lab
- General Electronics Environmental Test Facility
- Key Management Laboratory
- Crypto Technology Laboratory
- Navy Cyber Defense Research Laboratory (NCDRL)
- Communications Security (COMSEC) Laboratory
- Navy Shipboard Communications Testbed
- Behavior Detection Laboratory
- Virtual Reality Laboratory
- Service Oriented Architecture Laboratory
- Distributed Simulation Laboratory
- Motion Imagery Laboratory
- Global Information Grid - Evaluation Facility
- Laboratory for Large Data Research
- Affiliated Resource Center for High Performance Computing
- Ruth H. Hooker Research Library

## Institute for Nanoscience (Code 1100)

- Clean room (5000 sq ft), quiet (4000 sq ft), and ultra-quiet (1000 sq ft) laboratories
  - 35 dB and 25 dB acoustically isolated zones
  - 20ºC ± 0.5ºC and 0.1ºC controlled temperature zones
  - Vibration isolation
    - Vertical (mm, pp) <0.1 @ 70–500 Hz
    - Horizontal (mm, pp) <0.1 @ 70–500 Hz
  - Clean electrical power, free from SCR spikes and other interferences, and < ±10% voltage change
  - <0.5 mG at 60 Hz EMI
  - 45 ± 5% relative humidity
  - Class 100 clean room
  - Source of water meeting ASTM D5127 spec. Type E1.2
- Clean Room Major Equipment
  - Monitoring system (toxic gas, hazmat, temperature)
  - Laminar flow wet benches for localized Class 1/10 ambient in clean room
  - Air purification unit to remove local organic contamination
  - DI water system
  - Wire bonder
  - E-beam writer with active vibration control system
  - Scanning electron microscope
  - Atomic force microscope
  - Metallurgical optical microscopes
  - Surface profiler
  - Mask aligners (2, 1, and 0.2 μm)
  - Electron beam evaporation system
  - Low pressure chemical vapor deposition (LPCVD) system
  - Magnetron sputter deposition system
  - Reactive ion etching systems
  - Dual-beam focused ion beam workstation
  - Optical pattern generating system
  - Plasma-enhanced chemical vapor deposition (PECVD) system
  - Chlorine reactive ion etching system
- Other Major Equipment
  - Transmission electron microscope
  - UHV multi-tip scanning tunneling microscope/nanomanipulator
  - Plasma-enhanced atomic layer deposition system
  - Laser micromachining system

## Laboratory for Computational Physics and Fluid Dynamics (Code 6400)

- 1120-core x86 Cluster
- (3) 64-core SGI Altix Systems
- 184-core x86 Cluster
- 256-core SGI ICE
- 256-processor Opteron Cluster
- More than sixty SGI, Apple, and Intel workstations
- Three-quarter-terabyte RAID disk storage systems
- All computers and workstations have network connections to NICENET and ATDnet allowing access to the NRL CCS facilities (including the DoD HPC resources) and many other computer resources both internal and external to NRL

## Marine Geosciences Division (Code 7400)

- Airborne gravimetry, magnetics, and topographic measurements suite coupled with differential GPS yielding position accuracies of < 1.0 meter
- 100 and 500 kHz sidescan sonar with 2–12 kHz chirp profiler and Cs magnetometer for seafloor characterization/imaging and shallow subbottom profiling

Deep-towed acoustic geophysical system operating at 220–1000 Hz characterizes subseafloor structure including gas clathrate accumulations and dissociation of methane hydrates
Acoustic seafloor classification system operating at 8–50 kHz provides underway, real-time prediction of sediment type and physical properties
Seafloor probes for measuring sediment pore water pressures, permeability, electrical resistivity, acoustic compressional and shear wave velocities and attenuations, and dynamic penetration resistance
100 and 300 kV transmission electron microscopes with environmental cell for study of sediment fabric, especially impact of organic matter
Map data formatting facility compresses map information onto CD-ROM media for masters for use in aircraft digital moving map systems
Comprehensive geotechnical and geoacoustics laboratory capability
Airborne electromagnetic (AEM) bathymetry system
Ocean bottom magnetometer system
3D, multispectral, subbottom swath imaging system
Ocean bottom seismographs (OBS)
In situ sediment acoustic measurement system (ISSAMS)
Instrumented mine shapes to measure hydrodynamics of free-fall in the water column, dynamics of deceleration in seafloor sediments, and rates and depths of scour burial
Hydrothermal plume imaging data acquisition and analysis system
Integrated digital databases analysis and display system for bathymetric, meteorological, oceanographic, geoacoustic, and acoustic data
Stereometric video image processing system for use in foreshore morphology measurement
Sediment gas-content sampler
Acoustic tomographic probes for surf zone sands and gassy muds
Computed tomography (CT) system and real-time radiography unit with a 0–225 keV @ 0–1 mA microfocus X-ray tube and a 225-mm image intensifier
Patented Geospatial Information Data Base (GIDB™) for rapidly accessing disparate geospatial content on the internet. This is the most extensive interconnection of geospatial data that exists. http://dmap.nrlssc.navy.mil
Human-centered display design through the application of human factors principles in the design of geospatial displays (e.g., analysis of clutter in electronic displays)
GPS-based survey vehicles and equipment to measure foreshore and nearshore bathymetry (camera towers, jet ski, and push cart)
Geospatial visualization lab for rapid 2D and 3D graphic and physical visualization, analysis, and prototyping

## Marine Meteorology Division (Code 7500)

The USGODAE Data Server (Global Ocean Data Assimulation Experiment) for collection and distribution of near real-time METOC data and higher level products from Navy and other providers to the global ocean and atmospheric research community.
AN/SMQ-11 shipboard antenna system for retrieving polar-orbiting satellite data
Geostationary satellite data direct readout and polar orbiting satellite data processing center
Supercomputer for numerical weather prediction systems development
Master Environmental Library (MEL) implemented on superworkstations for archiving and distributing real-time and historical atmosphere/ocean databases
Bergen Data Center for extensive file serving on disks and research data backup/archival capability on tapes
Data visualization center for developing shipboard briefing tools, displaying observations and model output, and integrating meteorological parameters into tactical simulations
Classified radar and satellite data processing facility
Two mobile Atmospheric Aerosol and Radiation Characterization Observatories (MAARCO)
Technical Research Library

## Materials Science and Technology Division (Code 6300)

Hot isostatic press
Cold isostatic press
High-energy dispersive X-ray analytical system
Electron microprobe, SEM, SAM, and STEM systems
Quantitative metallography
Computer-controlled multiaxial loading and SCC measurement systems
Computer-aided experimental stress analysis
Crystallite orientation distribution function (CODF)
Class 1000 clean room; processing metallic film
Elevated temperature and structural characterization laboratory
Metallic film deposition systems
Magnetometry
Cryogenic facilities
High-field magnets
High-resolution analytical electron microscope
Isothermal heat treating facility
Vacuum arc melting facility
Vacuum induction melting facility
3-MeV tandem Van de Graaff accelerator
200-keV ion-implantation facility
Precision colorimeters
Polymer synthesis and characterization
Microwave device test facility
Excimer laser film deposition facility
Bomen infrared spectrometer facility
Diffuse light scattering facility

Femtosecond laser facility
Surface characterization facility
Accelerator mass spectrometry facility
Carbon-14 dating facility
Laminated object manufacturing system
Thermal analysis characterization suite (TGA/DSC/DMA/DEA/rheometer)
Dielectric characterization facility
Composites processing autoclave
3D ESPI strain measurement system
Biomechanical surrogate fabrication facility

## Oceanography Division (Code 7300)

Towed sensor and advanced microstructure profiler systems for studying upper ocean fine and microstructure
Integrated absorption cavity and optical profiler systems for studying ocean optical characteristics
Self-contained bottom-mounted upwardlooking acoustic profilers for measuring ocean variability
Acoustic Doppler profiler for determining ocean currents while under way
Remotely operated underwater vehicle (ROV)
Bottom-mounted acoustic Doppler profilers
Towed hyperspectral optical array
SCI processing facility
Satellite receiving stations for AVHRR, MODIS, and DMSP ocean color processing facility
Environmental scanning electron microscope, confocal laser scanning microscope, and the new Inspect S Low Vacuum Scanning Electron Microscope for detailed studies of biocorrosion in naval materials
Real-time Ocean Observations and Forecast Facility for monitoring and tracking of ocean physical and bio-optical conditions
Slocum Electric Gliders for performing wide-area ocean surveys of temperature, salinity, and optical characteristics
SCANFISH MKII, a towed undulating vehicle system, designed for collecting 3D TS profile data of the water column
Bottom-mounted Shallow water Environmental Profiler in Trawl-safe Real-time configuration (SEPTR) for measuring temperature, salinity, and some optical parameters in addition to current profiles and pressure

## Optical Sciences Division (Code 5600)

Optical probes laboratory to study viscoelastic, structural, and transport properties of molecular systems
Short-pulse excitation apparatus for kinetic mechanisms investigations
IR laser facility for optical characterization of semiconductors
Facilities for synthesis and characterization of optical glass compositions and for the fabrication of optical fibers
Silica and IR fluoride/chalcogenide fiber fabrication facilities
Environmental testing of fiber sensors (acoustic, magnetic, electric field, etc.)
Laser diode pumped solid-state lasers
Mid-IR, low-phonon crystal growth facility
Infrared countermeasure techniques laboratory
Mobile, high-precision optical tracker
Indoor IR test range
Computer EO/IR technology/systems simulation center
Field-qualified EO/IR measurement devices
Focal plane array evaluation facility
Facilities for fabricating and testing integrated optical devices
Panchromatic and multi- and hyper-spectral digital imaging processing facilities
NRL P-3 aircraft sensor pallet
Airborne EO/IR and radar sensors
  VNIR through SWIR hyperspectral systems
  VNIR, MWIR, and LWIR high-resolution systems
  Wideband SAR systems
RF and laser data links
High-speed, high-power photodetector characterization
Communication link characterization to >100 Gbps
RF phase noise, noise figure, and network analysis
Ultrahigh-speed A/O converters

## Plasma Physics Division (Code 6700)

Mercury, 6 MV, 360 kA, magnetically insulated inductive voltage adder
Gamble II, 1 MV, 1 MA pulsed power generator
HAWK, 1 MA inductive storage facility
PHAROS III, two-beam neodymium-glass laser and target facility
Table-Top Terawatt ($T^3$) laser system
Table-Top Ti: Sapphire Femtosecond Laser (TFL) system
NIKE krypton fluoride laser facility
Space Physics Simulation Chamber
Plasma Applications Laboratory
Microwave facility for processing of advanced materials (2.45, 35, 83, and 60–120 GHz)
ELECTRA, test bed for high-rep 5 Hz KrF laser
Railgun Materials Testing Facility
Directed Energy Physics Facility
SWOrRD laser facility

## Radar Division (Code 5300)

Shipboard radar research and development test beds:
  AMRFC testbed
  Wideband digital beamforming testbed
  AN/SPS-49A(V)1
Airborne research radar facility, including advanced profile high-resolution imaging radar and P-3 (1998) with APS-145 Group 2 and CEC
High-power 94 GHz radar system
Ultrahigh resolution radar system (microwave microscope)

- Radar signature calculation facility
- Electromagnetic numerical computation facility
- Compact range antenna measurement laboratory and nearfield scanner
- Space-time adaptive processing (STAP) laboratory
- Electronic computer-aided design facility
- Clutter research radar
- Microwave and RF instrumentation laboratory
- Functional materials electromagnetic analysis laboratory
- High-bandwidth, high-capacity data recording system

## Remote Sensing Division (Code 7200)

- Ground-based stratospheric water-vapor monitoring system
- SAR processing facility
- SCI processing facility
  - SEALAB
  - SAIL
- Hyperspectral imaging, sensors, and processing
- Optical remote sensing calibration lab/facility
- Navy Prototype Optical Interferometer (NPOI)
- NRL/NRAO 74-MHz Very Large Array
- Free surface hydrodynamics laboratory (including a 10-m wave tank)
- SSM/I processing facility
- Volume imaging lidar system
- Aerosol and field measurement facility
- NRL RP-3A aircraft sensors
  - Airborne polarimetric microwave imaging radiometer (APMIR)
  - Airborne Lidar
  - mm-wave imager
  - DMSP SSM/I simulator
  - Interferometric Synthetic Aperture Radar (InSAR)
  - Flight-level meteorological sensors
  - Hyperspectral sensor systems (PHILLS)
  - Mid-wave infrared (MWIR) Indium Antimonide (InSb) imaging system
  - Long-wave infrared (LWIR) quantum well IR photodetector (QWIP) imaging system

## Research and Development Services Division (Code 3500)

- Military construction
- Research support engineering
- Planning
- Full range of facility contracting, including construction, architect/engineering services, facilities support, and reserved parking
- Transportation
- Telephone services
- Maintenance and repair of buildings, grounds, and communication and alarm systems
- Shops for machining, sheet metal, welding, and plating
- Occupational Safety and Health
- Environmental
- Health Physics

## Spacecraft Engineering Department (Code 8200)

- Chambers:
  - Thermal-vacuum
  - Acoustic reverberation
  - Large, tapered horn, RF anechoic chamber
  - EMI/EMC testing chamber
- Facilities:
  - Spacecraft high-reliability electronic and electrical rework facility
  - Spacecraft electronic systems integration and test facility
  - Radio frequency (RF) system development facility
  - RF microcircuit fabrication cleanroom facility
  - Large tapered horn RF anechoic chamber facility
  - Frequency Sources Laboratory
  - Shock and vibration test
  - Cleanrooms (multiple classes and sizes)
  - Spacecraft fabrication and assembly
  - Fuels testing
  - Autoclave
  - Space robotics laboratory
  - Proximity operations testbed
  - CAD/CAM
  - Propulsion system welding
  - Static loads test
  - Star tracker characterization
  - Spacecraft spin balance
  - Modal analysis
  - Computational astrodynamic simulation and visualization

## Space Science Division (Code 7600)

- Development and test facilities for satellite, sounding rocket, and balloon instruments, to perform solar terrestrial, astrophysical, astronomical, solar, upper/ middle atmospheric, and space environment sensing
- Infrared Test Facility (IRTF)
- Solar Coronagraph Optical Test Chamber (SCOTCH)
- Vacuum Ultraviolet Calibration Facility (VUCF)
- Gamma Ray Imaging Laboratory (GRIL)
- Mobile Imaging and Spectroscopic Threat Identification (MISTI)
- Doppler Asymmetric Spatial Heterodyne Spectroscopy (DASH) balloon instrument
- Helium Resonant Scattering in the Corona & Heliosphere (HERSCHEL) sounding rocket instrument
- Very high angular Resolution Imaging Spectrometer (VERIS) sounding rocket instrument
- Remote Atmospheric and Ionospheric Detection System (RAIDS) International Space Station instrument

Extreme Ultraviolet Imaging Spectrometer (EIS) satellite instrument
Sun Earth Connection Coronal and Heliospheric Investigation (SECCHI) satellite instrument suite
Solar Orbiter Heliospheric Imager (SoloHI) satellite instrument
Special Sensor Ultraviolet Limb Imager (SSULI) satellite instrument
Spatial Heterodyne Imager for Mesospheric Radicals (SHIMMER) satellite instrument
Atmospheric Neutral Density Experiment (ANDE) microsatellite
Extensive computer-assisted data manipulation, interpretive, and theoretical capabilities for space science instrumentation operations, data imaging, and modeling
SECCHI Payload Operations Center (POC)
Fermi Gamma-ray Space Telescope (formerly GLAST) Science Analysis Center (SAC)
Simulation of radiation detection and systems in space and terrestrial environments (SWORD & SMART)
Mountain Wave Forecast Model (MWFM)
Advanced Level Physics High Altitude extension of the Navy Operational Global Atmospheric Prediction System (NOGAPS-ALPHA)
Synthetic Scene Generation Model (SSGM)
Integrating the Sun-Earth System for the Operational Environment (ISES-OE)

## Space Systems Development Department (Code 8100)

Payload test facility and processor development laboratory
Laser communications and electro-optics laboratories
Tactical Technology Development Laboratory (TTDL)
Precision oscillator (clock) test facility
RF payload development laboratory with anechoic chamber
Precision high-frequency RF compact range anechoic chamber facility
Transportable ground station development, assembly, and test facility
Multiplatform FPGA/ASIC/VLSI development laboratory
Satellite telemetry, tracking, and satellite control at Blossom Point, MD
- L/C/S/X-band fixed antenna resources
- Connectivity to the Air Force Satellite Control Network (AFSCN)

Pomonkey field site—large antenna, space communications, and research facility
Midway Research Center—space communications and research facility
Optical telescope facility

## Tactical Electronic Warfare Division (Code 5700)

Visualization Laboratory
Transportable step frequency radar
Vehicle development laboratory
Offboard test platform
Compact antenna range facility
Isolation measurement chamber facility
RFCM techniques chamber facility
Search radar ECM/EA simulator
Low-power anechoic chamber
High power microwave research facility
Electro-optics mobile laboratory
Infrared-electro-optical calibration and characterization laboratory
Infrared missile simulator and development laboratory
Secure supercomputing facility
CBD/Tilghman Island IR field evaluation facility
Ultrashort pulse laser effects research and analysis laboratory
Central Target Simulator facility
Flying Electronic Warfare laboratory
High power RF explosive laboratory
Classified material lay-up facility
Classified computing facilities
RF measurement laboratory
Wet chemistry laboratory
Ultra near field test facility
RF and millimeter-wave laboratory
Optical laboratory
Paint room
Secure laboratories for classified projects

# NRL Sites and Facilities

| SITE | ACREAGE | | BUILDINGS/ STRUCTURES |
|---|---|---|---|
| | LAND OWNED/LEASED | EASEMENT/ LICENSE-PERMIT | |
| **District of Columbia** | | | |
| NRL and Artificial Intelligence Center at Bolling AFB* | 131/0 | 0/10.13 | 89/28 |
| **Virginia** | | | |
| Midway Research Center Quantico* | 162/0 | 0/0 | 7/11 |
| **Maryland** | | | |
| NRL Scientific Development Squadron One (VXS-1), NAS Patuxent River* | Tenant | | |
| Chesapeake Bay Section and Dock Facility Chesapeake Beach* | 168/0 | .6/.02 | 45/75 |
| Multiple Research Site Tilghman Island* | 3/0 | 0/0 | 3/3 |
| Free Space Antenna Range Pomonkey* | 55/0 | 29.4/0 | 10/10 |
| Blossom Point Satellite Tracking and Command Station Blossom Point* | 0/0 | 0/265 | 22/23 |
| **Florida** | | | |
| Marine Corrosion Facility Key West | Tenant | | |
| **California** | | | |
| NRL Monterey Monterey* | Tenant | | |
| **Mississippi** | | | |
| Stennis Space Center Bay St. Louis* | Tenant | | |
| **Alabama** | | | |
| Ex-USS *Shadwell* (LSD-15) Mobile Bay | Tenant | | |
| Decommissioned 457-ft vessel used for fire research | | | |

**PROPERTY**

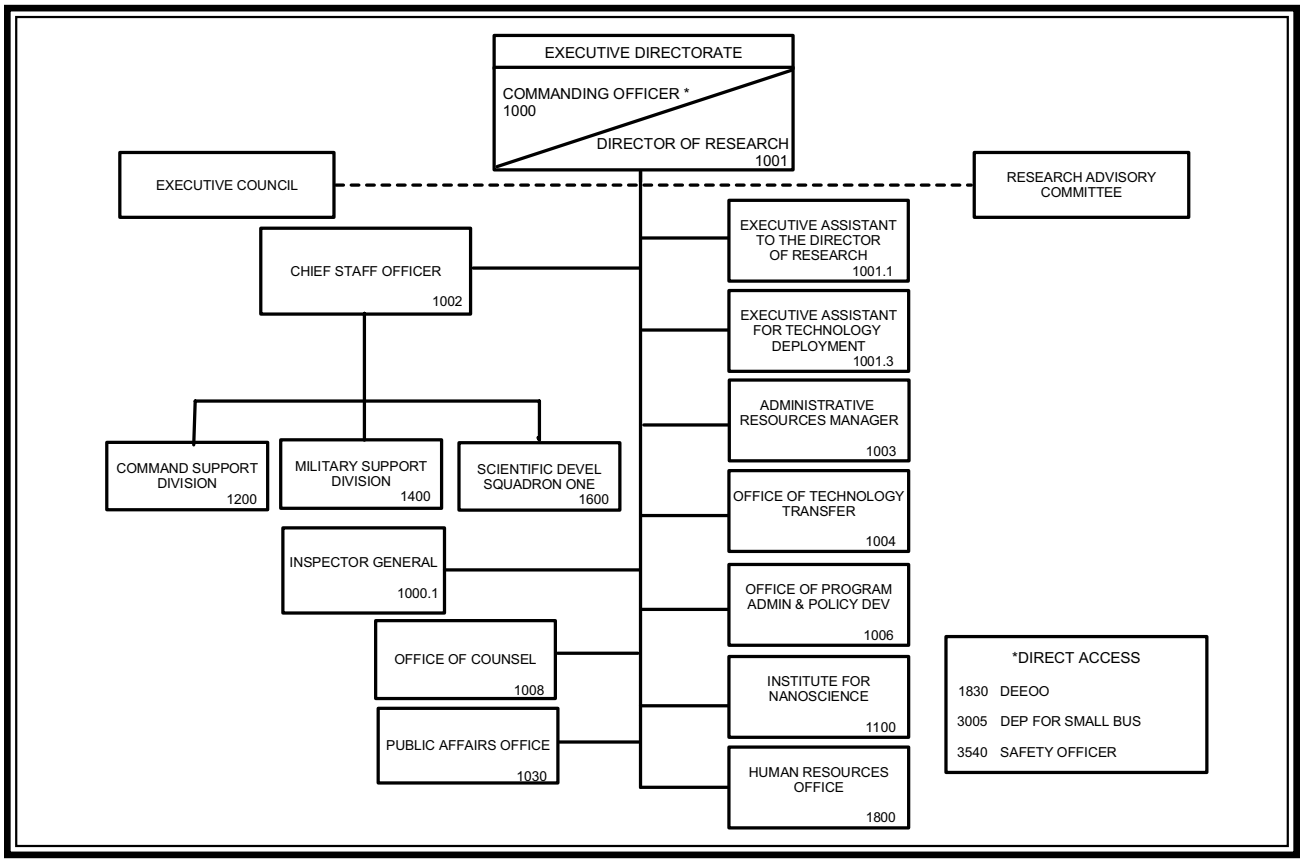
**Land:** 824 acres

| **Buildings:** | |
|---|---|
| RDT&E | 3,183,094 ft$^2$ |
| Administrative | 249,121 ft$^2$ |
| Other | 266,749 ft$^2$ |

| **Replacement Costs:** | |
|---|---|
| Buildings Plant Replacement Value (PRV)[1] | $1,252.0 million |
| Equipment Costs[2] | $523.7 million |

[1]Per DON Facilities Asset Data System standard cost factors.
[2]NRL Accountable Property Acquisition Costs
*See maps in the General Information section (page 131).

# Executive Directorate




## Key Personnel

| Name | Title | Code |
|---|---|---|
| CAPT P.C. Stewart, USN | Commanding Officer | 1000 |
| Dr. J.A. Montgomery | Director of Research | 1001 |
| Mr. D.J. DeYoung | Executive Assistant | 1001.1 |
| Ms. C.L. Downing | Head, Strategic Workforce Planning | 1001.2 |
| Mr. B. Kiviat | Executive Assistant for Technology Deployment | 1001.3 |
| Dr. Leo Slater | NRL Historian | 1001.15 |
| CAPT T. Brewer, USN | Chief Staff Officer/Inspector General | 1002/1000.1 |
| Vacant | Deputy Head, Command Support Division/ Deputy Inspector General | 1000.11 |
| Ms. A.E. Downing | Command Management Review | 1000.12 |
| Ms. L.T. McDonald | Administrative Resources Manager | 1003 |
| Dr. R.C. Manak | Head, Office of Technology Transfer | 1004 |
| Vacant | Head, Office of Program Administration and Policy Development | 1006 |
| Mr. J.N. McCutcheon | Head, Office of Counsel | 1008 |
| Mr. R.L. Thompson | Head, Public Affairs Branch | 1030 |
| Dr. Eric Snow | Director, Institute for Nanoscience | 1100 |
| Ms. L.T. McDonald | Head, Command Support Division | 1200 |
| CDR J.J. Coffey, USN | Head, Military Support Division | 1400 |
| CDR C.D. Janke, USN | Commanding Officer, Scientific Development Squadron One (VXS-1) | 1600 |
| Ms. C.L. Downing* | Director, Human Resources Office | 1800 |
| Ms. L.L. Hill | Deputy Equal Employment Opportunity Officer | 1830 |
| Ms. T. Horsey | Deputy for Small Business | 3005 |
| Mr. K.J. Pawlovich | Head, Safety Branch | 3540 |

*Acting

# EXECUTIVE DIRECTORATE

## Code 1000 and Code 1001

The Commanding Officer (Code 1000) and the Director of Research (Code 1001) share executive responsibility for the management of the Naval Research Laboratory. In accordance with Navy requirements, the Commanding Officer is responsible for the overall management of the Laboratory and exercises the usual functions of command including compliance with legal and regulatory requirements, liaison with other military activities, and the general supervision of the quality, timeliness, and effectiveness of the technical work and of the support services.

The Commanding Officer delegates line authority and assigns responsibility to the Director of Research for the Laboratory's technical program, its planning, conduct, and staffing; evaluation of the technical competence of personnel; liaison with the scientific community; selection of subordinate technical personnel; exchange of technical information; and the effective execution of the NRL mission.

Within the limits of Navy regulations, the Commanding Officer and the Director of Research share authority and responsibility for the internal management of the Laboratory. The Commanding Officer retains all authority and responsibility specifically assigned to him by higher authority.

The mission of the Laboratory is carried out by three science and technology directorates and the Naval Center for Space Technology, supported by the Business Operations Directorate and the Executive Directorate. In addition, the Laboratory's operating staffs provide assistance in their special fields to the Commanding Officer and to the Director of Research. The operating staffs are listed on the following pages of this publication.

# Commanding Officer

**Captain Paul C. Stewart**, a native of Longmeadow, Massachusetts, graduated cum laude from Hartwick College of Oneonta, New York in May 1983 with a bachelor of science degree in mathematics. He was commissioned an Ensign in 1984 at Officer Candidate School in Newport, Rhode Island.

His first operational assignment was on board USS *Constant* (MSO 427), home ported in San Diego, California, from 1985 to 1987. Captain Stewart served as First Lieutenant, Supply Officer, Mine Counter Measures Officer and Executive Officer during this tour and qualified as an unrestricted line Surface Warfare Officer. After this sea tour, Captain Stewart was assigned to the Pre-Commissioning Unit Princeton; following extensive Aegis training, he commissioned USS *Princeton* (CG 59) in February 1989 as the Combat Information Center and Assistant Operations Officer. *Princeton* participated in combat systems qualification tests and evaluation of the new SPY-1B radar and fired 24 Tomahawk, Harpoon and SM-2 missiles. *Princeton* then completed several months of workups and training enroute to the Gulf War.

From 1990 to 1992, Captain Stewart was a student at the United States Naval Postgraduate School in Monterey, California where he was awarded a master of science degree in physics (meteorology and oceanography). In 1992, Captain Stewart reported to Naval Pacific Meteorology and Oceanography Center, Pearl Harbor where he qualified as Command Duty Officer and Typhoon Duty Officer; additionally, he served as Technical Services Officer and Fleet Services Officer.

Upon completion of his Department Head tour in Pearl Harbor, Captain Stewart reported to Commander, Cruiser-Destroyer Group Two aboard USS *George Washington* (CVN 73) as Staff Oceanographer and Assistant Operations Officer. The Battle Group participated in extensive operations in the Mediterranean, Adriatic, Red Sea and Arabian Gulf; additionally, he qualified as Fleet Tactical Action Officer.

Following his Battle Group tour, Captain Stewart reported for duty to the Bureau of Naval Personnel in Washington, DC as the assistant Oceanography and Meteorology assignment and placement officer; in 1998, he made the Bureau's transition to Tennessee. In 2000, Captain Stewart reported to the Oceanographer of the Navy as a requirements officer, after which he served as the Special Assistant for Ocean Resources and International Activities to the Assistant Secretary of the Navy (Installations and Environment). From 2002 to 2003, Captain Stewart studied at the National War College where he earned a master of science degree in national security strategy. In October 2003, Captain Stewart assumed command as the Commanding Officer/Director of the National Ice Center in Washington, DC. From 2005 to 2008, Captain Stewart served at the Office of Naval Research as the Deputy Director for the Ocean Battlespace Sensing Department and the Division Director of the Ocean, Atmospheric and Space Sensing and Systems Division; additionally he served as the U.S. National Liaison Officer to the NATO Undersea Research Center in La Spezia, Italy. In September 2008, Captain Stewart reported to the Naval Research Laboratory as the prospective Commanding Officer.

Captain Stewart's awards include the Legion of Merit, Meritorious Service Medal with gold star, Navy and Marine Corps Commendation Medal with gold stars in lieu of third award, Navy and Marine Corps Achievement Medal with gold stars in lieu of fourth award, National Defense Service Medal with bronze star, Armed Forces Expeditionary Medal, Southwest Asia Service Medal, Military Outstanding Volunteer Service Medal, NATO Medal, Expert Rifleman Medal, and Expert Pistol Medal.

# Director of Research

**Dr. John A. Montgomery** received his bachelor of science degree in physics from North Texas State University in 1967 and his master's degree, also in physics, in 1969. He received his Ph.D. in physics from the Catholic University of America in 1982. As Director of Research at the Naval Research Laboratory, Dr. Montgomery oversees research and development expenditures of approximately $1 billion per year.

Dr. Montgomery joined the Naval Research Laboratory in 1968 as a research physicist in the Advanced Techniques Branch of the Electronic Warfare Division, where he conducted research on a wide range of electronic warfare (EW) topics. In 1980, he was selected to head the Off-Board Countermeasures Branch. In 1985, he was appointed to the Senior Executive Service and was selected as Superintendent of the Tactical Electronic Warfare Division. He has been responsible for numerous systems that have been developed/approved for operational use by the Navy and other services. He has had great impact through the application of advanced technologies to solve unusual or severe operational deficiencies noted during world crises, most recently in the Persian Gulf, in the Kosovo campaign, in Afghanistan, and for homeland defense. Dr. Montgomery has accumulated 39 years of civilian service to date at the Naval Research Laboratory.

Dr. Montgomery received the Department of Defense Distinguished Civilian Service Award in 2001. He was recognized with the Department of the Navy Distinguished Civilian Service Award in 1999 and the Department of the Navy Meritorious Civilian Service Award in 1986. As a member of the Senior Executive Service, he received the Presidential Rank of Distinguished Executive award in 1991 and again in 2002, and the Presidential Rank of Meritorious Executive award in 1988, 1999, and again in 2007. He received the Laboratory Director of the Year award given by the Federal Laboratory Consortium in 2006. He also received the 1997 Dr. Arthur E. Bisson Prize for Naval Technology Achievement, awarded by the Chief of Naval Research in 1998. Further, he received the Association of Old Crows (Electronic Defense Association) Joint Services Award in 1993. He was an NRL Edison Scholar, and is a member of Sigma Xi. He served as the U.S. National Leader of The Technical Cooperation Program's multinational Group on Electronic Warfare from 1987 to 2002, and served as its Executive Chairman.

# Executive Council

The Executive Council consists of executive, management, and administrative personnel. Executive Council members include the following:

Commanding Officer, Chairperson
Director of Research
Associate Directors of Research
Chief Staff Officer
Director, Naval Center for Space Technology
Heads of Divisions
Head, Laboratory for Computational Physics and Fluid Dynamics
Head, Center for Bio/Molecular Science and Engineering
Director, Human Resources Office
Public Affairs Officer
Deputy Equal Employment Opportunity Officer
Administrative Resources Manager
Head, Office of Program Administration and Policy Development
Safety Officer
Head, Office of Counsel
Head, Office of Technology Transfer

# Research Advisory Committee

The Research Advisory Committee advises the Commanding Officer and the Director of Research on scientific programs and the administration of the Laboratory. The committee assists in planning the long-range scientific program, coordinating the scientific work, reviewing the budget, accepting or modifying problems, considering personnel actions, and initiating such studies as may be necessary or desirable. The membership consists of the following:

Director of Research, Chairperson
Commanding Officer
Associate Directors of Research
Chief Staff Officer (Observer)

CAPT T.B. Brewer, USN

## Chief Staff Officer/Inspector General
## Code 1002/1000.1

The Chief Staff Officer serves as the Deputy to the Commanding Officer and acts for the Commanding Officer in his absence. The Command Support Division (Code 1200), the Military Support Division (Code 1400), and the Scientific Development Squadron One (VSX-1) (NAS Patuxent River, MD, Code 1600) report directly to the Chief Staff Officer. When directed, the Laboratory's Inspector General investigates, inspects, and/or inquires into matters that affect the operation and efficiency of NRL. These matters include but are not limited to: effectiveness, efficiency, and economy; management practices; and fraud, waste, and abuse. He serves as principal advisor to the Commanding Officer on all inspection matters and audits and is the principal point of contact and liaison with all agencies outside NRL.

Mr. R.L. Thompson

## Public Affairs Officer
## Code 1030

The Public Affairs Officer (PAO) advises the Commanding Officer and Director of Research on public affairs matters, including external and internal relations and community outreach, and serves as the Commanding Officer's principal assistant in the area of public affairs. To do this, the PAO plans and directs a program of public information dissemination on official NRL activities. The PAO coordinates responses to requests from the news media and the public for unclassified information or materials dealing with the Laboratory, coordinates participation in community relations activities, and directs the internal information programs. The PAO is also responsible for coordinating all actions within the Laboratory that respond to requirements of the Freedom of Information Act (FOIA).

## Deputy Equal Employment Opportunity Officer
## Code 1830

The Deputy Equal Employment Opportunity Officer (DEEOO) is the EEO program manager and the advisor to the Commanding Officer on all EEO matters. The DEEOO manages the discrimination complaint process and directs the Laboratory's affirmative action plans and special emphasis programs (Federal Women's, Hispanic Employment, African American Employment, Asian-Pacific Islanders, American Indian Employment, Individuals with Disabilities, including Disabled Veterans). The DEEOO recruits quality candidates for those areas when underrepresentation exists. Duties also include reviewing, coordinating, and monitoring implementation of EEO policies and developing local guidance, directives, and implementation procedures for the EEO programs.

# Office of Technology Transfer

## Code 1004

## Basic Responsibilities

The Technology Transfer Office (TTO) is responsible for NRL's implementation of the Federal Technology Transfer Act of 1986 (Public Law 99-502). The law requires the transfer of Government innovative technologies to industry for commercialization as products and services for public benefit. TTO negotiates Cooperative Research and Development Agreements (CRADAs) under which NRL investigators collaborate with investigators from industry, academia, state or local governments, or other federal agencies to develop NRL technologies for government and/or commercial use. It markets NRL's patented inventions, negotiates patent license agreements under which the Navy grants a licensee the right to make, use, and sell NRL inventions (in exchange for receiving licensing fees and a percentage of sales), and enforces licenses to assure diligence in commercialization efforts.

**Personnel:** 6 full-time civilian; 1 part-time civilian, 1 STEP student

## Key Personnel

| Title | Code |
|---|---|
| Head, Technology Transfer | 1004 |
| Sr. Licensing Associate | 1004 |
| Sr. Licensing Associate | 1004 |
| Licensing Associate | 1004 |
| Management and Program Analyst | 1004 |
| Management Analyst | 1004 |
| Administrative Assistant | 1004 |

**Point of contact:** Code 1004, (202) 767-7229

# Office of Program Administration and Policy Development

## Code 1006

## Basic Responsibilities

The Office of Program Administration and Policy Development provides managerial, technical, and administrative support to the Director of Research (DOR) in such areas as program and policy development, intra-Navy and inter-Service Science and Technology (S&T) program coordination; liaison with other Navy, DoD, and government activities on matters of mutual concern; and support to the Executive Directorate in planning and directing NRL's S&T (6.1, 6.2) program. Specific functions include: monitoring and providing background information on technical and policy matters that come under the purview of the DOR; representing NRL, ONR, and/or the Navy on tri-Service or DoD-wide coordination matters; performing special studies or chairing ad hoc study groups regarding program decisions or policy positions; performing special studies involving major NRL programs and resource issues; providing administrative support in the areas of personnel, budget, facilities, equipment, and security; providing executive management information and analyses for various aspects of the S&T program effort; coordinating VIP visits to NRL; managing the NRL directives system; administering the NRL response to Congressional requests; maintaining the NRL R&D achievements file; developing the S&T guidance for monitoring and reporting the NRL S&T program; administering NRL's various postdoctoral fellowship programs; and managing the Facility Modernization Program.

**Personnel:** 14 full-time civilian

## Key Personnel

| Title | Code |
|---|---|
| Head, Office of Program Administration and Policy Development | 1006 |
| Head, Program Administration Staff | 1006.1 |
| Administrative Officer | 1006.2 |
| Head, Executive Management & Policy Development Staff | 1006.3 |
| Directives | 1006.31 |
| Head, NRL Facilities Staff | 1006.4 |
| Special Assistant | 1006.6 |

**Point of contact:** Code 1006.2, (202) 767-3370

# Office of Counsel

## Code 1008

## Basic Responsibilities

The Office of Counsel is responsible for providing legal services to NRL's management in all areas of general, administrative, intellectual property, and technology transfer law. The Office reviews all procurement-related actions; reviews NRL scientific papers prior to publication; prepares patent applications and prosecutes the applications through the Patent and Trademark Office; defends against contract protests, other contract litigation, and personnel cases; and advises on other legal matters relating to technology transfer, personnel, fiscal, and environmental law.

NRL Counsel also serves as legal advisor to the Commanding Officer and Director of Research.

**Personnel:** 28 full-time civilian

## Key Personnel

| Title | Code |
|---|---|
| Head, Office of Counsel | 1008 |
| Associate Counsel/General Law | 1008.1 |
| Associate Counsel/Intellectual Property | 1008.2 |
| Associate Counsel/SSC Legal Matters | 1008.3 |

**Point of contact:** Code 1008.1, (202) 767-7606

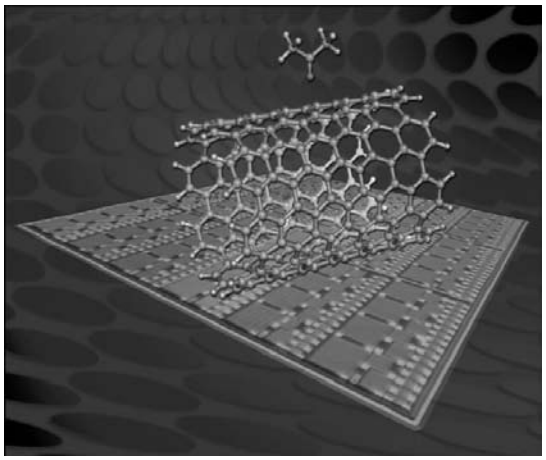
# Institute for Nanoscience

## Code 1100
## Staff Activity Areas

- Interdisciplinary nanoscience that enables:
  - Low power, high-speed electronics
  - Light-weight, high-strength materials
  - Highly sensitive molecular sensors
  - Efficient energy generation and storage

NRL researchers working in the Institute for Nanoscience class 100 cleanroom.

Transmission electron microscope located in one of the Institute for Nanoscience's environmentally controlled laboratories.



Wafer of carbon nanotube chemical sensors fabricated in the Institute for Nanoscience cleanroom.

# Code 1100

## Basic Responsibilities

The Institute for Nanoscience has two primary responsibilities, to administrator an interdisciplinary research program in nanoscience and to provide NRL scientists with high-quality laboratory space and state-of-the-art nanofabrication facilities.

The mission of the research program is to conduct highly innovative, interdisciplinary research at the intersections of the fields of materials, electronics and biology in the nanometer size domain. The Institute exploits the broad multidisciplinary character of NRL to bring together scientists and engineers with disparate training and backgrounds to attack common goals at the intersection of their respective fields at this length scale. The Institute's S&T programs provide the Navy and DoD with scientific leadership in this complex, emerging area and help to identify opportunities for advances in future Defense technology.

The Institute also operates a nanoscience research building containing nanofabrication facilities and environmentally-controlled measurement laboratories. The central core of the building, a 5000-square-foot class-100 cleanroom, has been outfitted with the newest tools to permit nanofabrication, measurement, and testing of devices. In addition to the cleanroom facility, the building also contains 5000 square feet of controlled-environment laboratory space, which is available to NRL researchers whose experiments are sufficiently demanding to require this space. There are 12 of these laboratories within the building. They provide shielding from electromagnetic interference and very low floor vibration and acoustic levels. Eight of the laboratories control the temperature to within ± 0.5 °C and four to within ± 0.1 °C.

**Personnel:** 4 full-time civilian

## Key Personnel

| Title | Code |
|---|---|
| Director, Institute for Nanoscience | 1100 |
| Position Assistant | 1100 |
| Facilities Manager | 1100 |
| Facilities Technician | 1100 |
| Facilities Technician | 1100 |

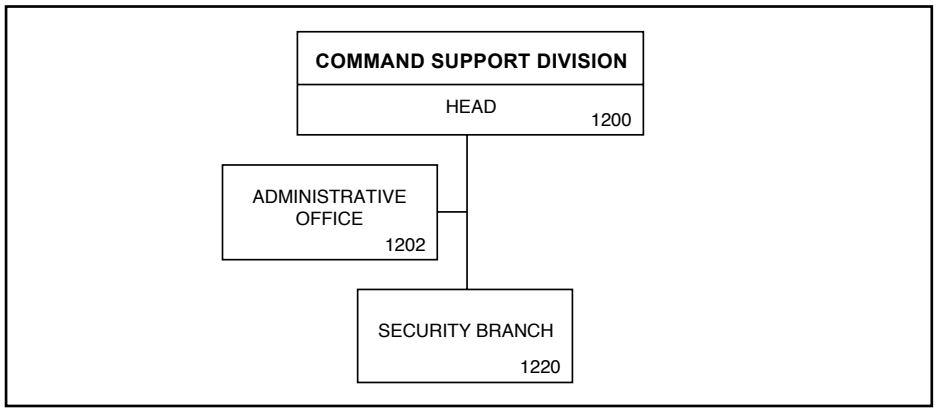
**Point of Contact:** Code 1100, (202) 767-1804

## Code 1200
## Staff Activity Areas

- Security

Incoming visitor reception area

Security monitoring




## Basic Responsibilities

The Command Support Division provides civilian staff to the Commanding Officer and to the Director of Research. The Division is responsible for the Laboratory's physical, personnel, information, industrial, and IT security programs; and communications service. It provides intelligence support and support for international cooperative agreements in technology. The Division also coordinates the Laboratory's Management Control Program and provides liaison and coordination for all audit and inspection teams. It provides Supervision of Administrative/Budget functions for the Security Branch, the Military Operations Branch, and the Scientific Development Squadron One (VXS-1).

**Personnel:** 54 full-time civilian

## Key Personnel

| Title | Code |
|---|---|
| Head, Command Support Division | 1200 |
| Administrative Officer | 1202 |
| Head, Security Branch | 1220 |
| Head, Information Assurance Section | 1221 |
| Head, Physical Security Section | 1222 |
| Head, Special Security Services | 1223 |
| Head, Personnel Security Section | 1224 |
| Head, Force Protection/Command Investigator Section | 1225 |
| Head, Information Security Section | 1226 |
| Head, Communications Security Section | 1227 |
| Head, NRL-SSC Security | 1228 |

**Point of contact:** Code 1202, (202) 767-6987

# Military Support Division

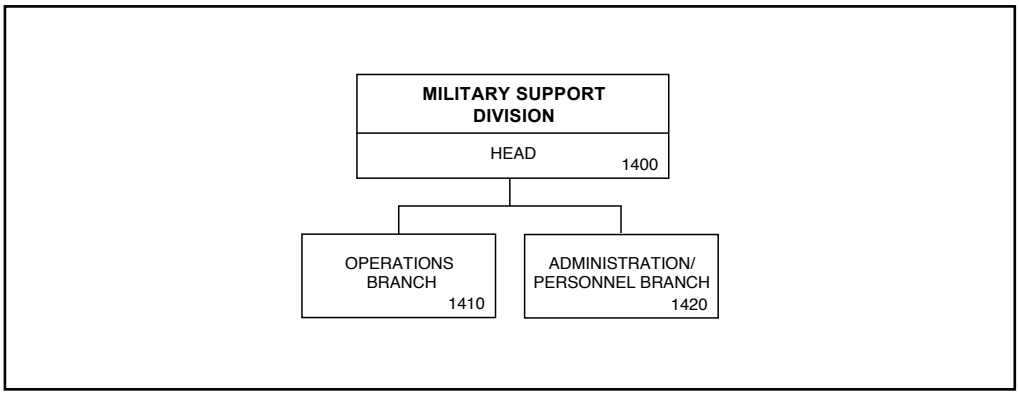
## Code 1400
## Staff Activity Areas

- Operations
- Administrative Operations

P-3 airborne research facility

Administration

CDR J.J. Coffey, USN




## Basic Responsibilities

The Military Support Division provides military operational and administrative services to NRL.

The Operations Branch assists NRL Research Directorates in planning and executing project flight missions, develops deployment schedules and military operational and training objectives, and coordinates the Research Reserve Program within NRL.

The Military Administration Branch is responsible for the coordination and efficient functioning of all military administrative operations for NRL (including site detachments). These duties specifically include: personnel actions, maintenance of personnel records, performance evaluations, awards and training; advising the Chief Staff Officer on manpower matters and organization issues; and preparing and administering the military operational budget.

**Personnel:** 1 full-time civilian; 10 military

## Key Personnel

| Title | Code |
|---|---|
| Director, Military Support Division | 1400 |
| Project Officer | 1400 |
| Project Officer | 1400 |
| Project Officer | 1400 |
| Administrative Officer | 1420 |

**Point of contact:** Code 1420, (202) 767-2103

# Scientific Development Squadron ONE (VXS-1)

## Code 1600
## Staff Activity Areas

- Operations
- Administrative Operations
- Aircraft Maintenance
- Safety/NATOPS

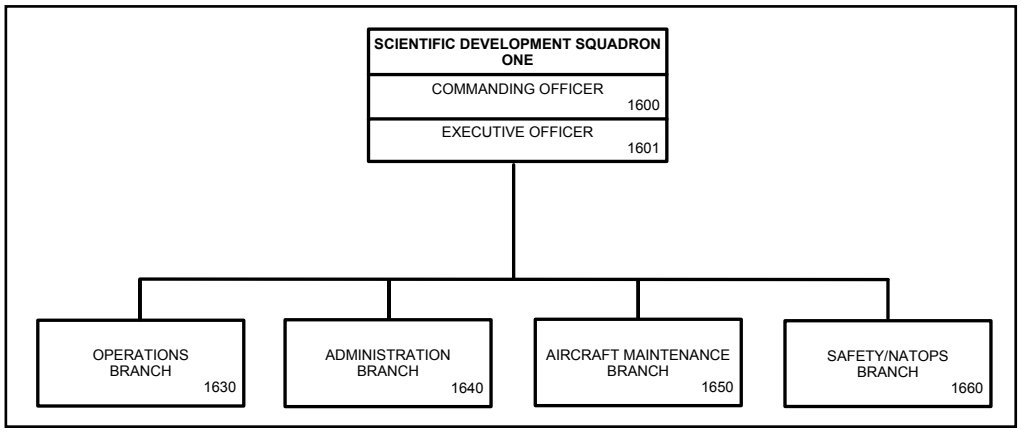
VXS-1 maintains two RC-12 aircraft dedicated to airborne research. They are smaller, more cost-efficient, alternatives to the P-3 Orion. Each aircraft is outfitted with a research electrical load center and has a roll-on roll-off capability which enables it to be equipped with project stations. The RC-12s can support a broad spectrum of project configurations.

Aircraft maintenance

P-3 airborne research facility

Scientific Development Squadron One hangar

CDR C.D. JANKE, USN




## Basic Responsibilities

The Scientific Development Squadron ONE (VXS-1) located at NAS Patuxent River, Maryland, operates and maintains three uniquely configured P-3 Orion aircraft and two C-12 aircraft. The men and women of the squadron provide the Naval Research Laboratory with airborne research platforms, conducting flights world-wide in support of a broad spectrum of projects and experiments. These include magnetic variation mapping, hydroacoustic research, bathymetry, electronic countermeasures, gravity mapping, and radar research. The squadron annually logs approximately 1000 flight hours, and in its 47 years, Scientific Development Squadron ONE (VXS-1) has amassed 69,000 hours of mishap-free flying.

**Personnel:** 12 full-time civilian; 95 military

## Key Personnel

| Title | Code |
|---|---|
| Commanding Officer, VXS-1 | 1600 |
| Executive Officer | 1600.1 |
| Senior Enlisted Advisor | 1600.2 |
| Executive Secretary | 1600.4 |
| Chief Project Officer | 1620 |
| Operations Officer | 1630 |
| Administrative Officer | 1640 |
| Maintenance Officer | 1650 |
| Assistant Maintenance Officer | 1650.1 |
| Maintenance/Material Control Officer | 1650.2 |
| Safety Officer | 1660 |
| NATOPS Officer | 1670 |
| Training Officer | 1670.1 |

**Point of contact:** Code 1600.4, (301) 342-3751; DSN 342-3751

# Human Resources Office

## Code 1800
## Staff Activity Areas

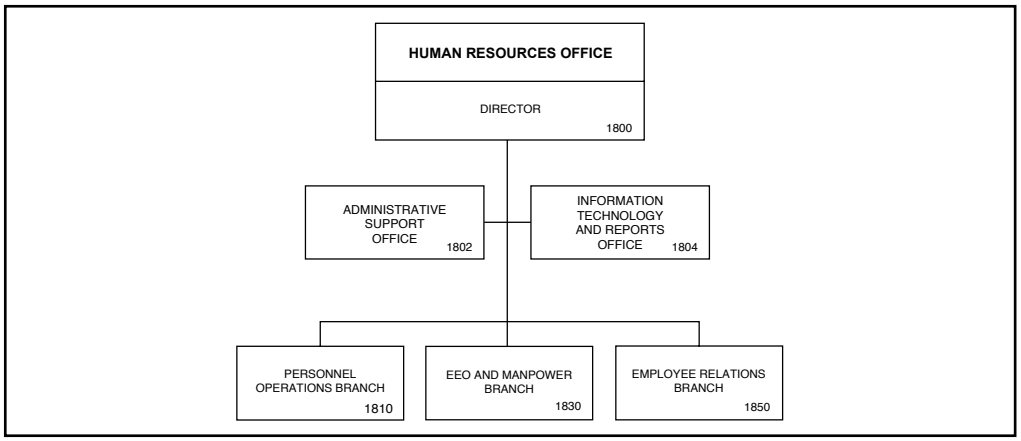
- Personnel Operations (Staffing and Classification)
- Employee Relations (Employee Development)
- Equal Employment Opportunity and Manpower
- Compensation, Reports, and Demonstration Project
- Information Technology and Reports

Personnel Operations Branch

EEO and Manpower Branch

Employee Relations Branch

Workforce Development and Management Branch




## Basic Responsibilities

The Human Resources Office (HRO) provides civilian personnel, manpower, and Equal Employment Opportunity (EEO) services to the Naval Research Laboratory. The Human Resources Program provides the full range of operating civilian personnel management in the staffing and placement, position classification, employee relations, labor relations, employee development, EEO functional areas, manpower management, and morale, welfare, and recreation programs.

The HRO at NRL's main site in Washington, DC, services approximately 2,500 employees and provides a centralized capability to perform managerial, service, and advisory functions in support of field office operations. These include issuing policy and procedural directives; developing, designing, and maintaining automated systems; and monitoring and evaluating product effectiveness to develop and maintain efficient, cost-effective, service-oriented methods.

**Personnel:** 27 full-time civilian

## Key Personnel

| Title | Code |
|---|---|
| Director, Human Resources Office | 1800 |
| Administrative Officer | 1802 |
| Head, Information Technology and Reports Branch | 1804 |
| Head, Personnel Operations Branch | 1810 |
| Head, Equal Employment Opportunity and Manpower Branch | 1830 |
| Head, Workforce Development and Management Branch | 1840 |
| Head, Employee Relations Branch | 1850 |

**Point of contact:** Code 1802, (202) 404-2797

# Business Operations Directorate

# BUSINESS OPERATIONS DIRECTORATE

## Code 3000

The Business Operations Directorate provides executive management, policy development, and program administration for business programs needed to support the activities of the scientific directorates. This support is in the areas of financial management, supply management, contracting, research and development services, and management information systems support.

# Associate Director of Research for Business Operations

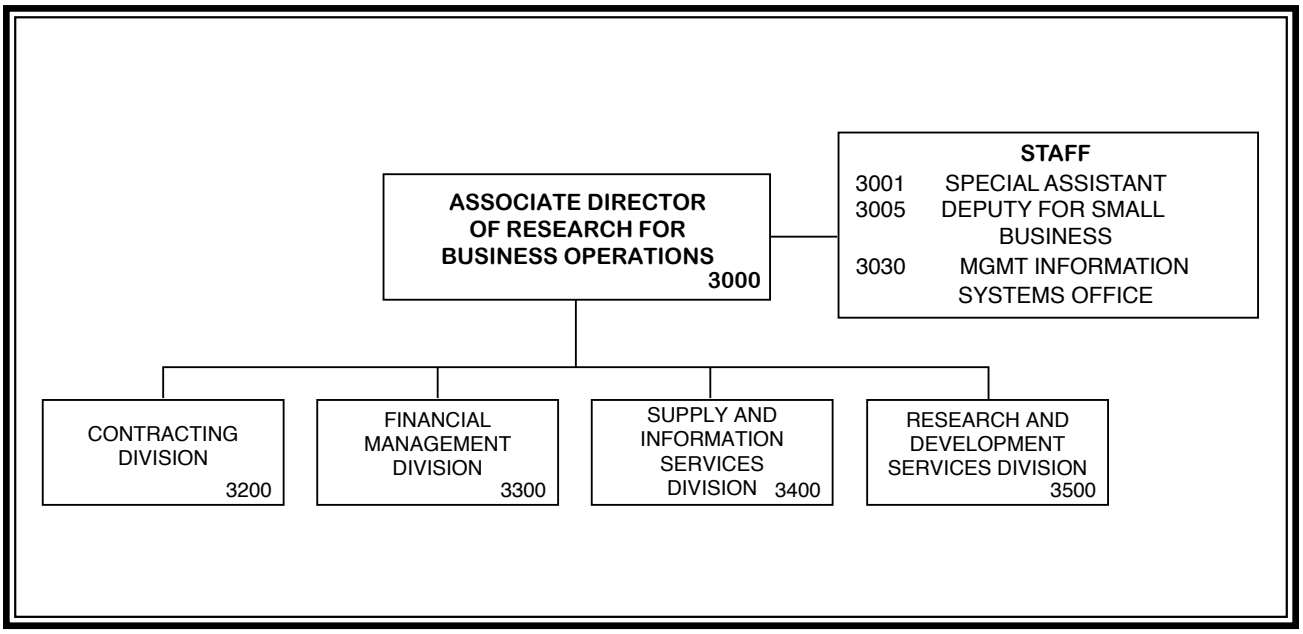
**Mr. D.K. Therning** was born in Modesto, California. He graduated from Washington State University with a bachelor's degree in finance in 1983 and earned a master's degree in business administration from George Mason University in 1993. Mr. Therning has accumulated extensive experience in the financial business management of research, development, test, and evaluation (RDT&E) activities within the Department of the Navy (DoN) beginning at the Naval Weapons Center, China Lake, California, where he served as a budget analyst in the Public Works Department and then in the Weapons Department. In 1984, he became the Financial Management Advisor to the Ordnance Systems Department. In 1985, under the auspices of the Naval Scientist Training and Exchange Program, he was selected for a one-year assignment in the Office of the Director of Naval Laboratories (DNL), Washington, DC. He remained on the DNL staff as a budget analyst until 1987, when he was appointed Budget Officer of the DNL's seven Navy Industrial Fund R&D laboratories.

As the DoN reorganized the R&D laboratories and T&E activities, Mr. Therning oversaw the financial reorganization of the DNL labs with other activities into the Naval warfare centers. Upon the disestablishment of DNL, Mr. Therning remained in the Space and Naval Warfare Systems Command as the Director of the Defense Business Operations Fund (DBOF) Resources Management Division, with collateral duty as the Financial Manager of the Naval Command, Control, and Ocean Surveillance Center (NCCOSC). During this time, he managed the conversion of nine appropriated fund engineering activities to DBOF and the financial consolidation of these activities with NCCOSC.

In 1995, Mr. Therning served as Head of the Revolving Funds Branch of the Office of the Assistant Secretary of the Navy (Financial Management and Controller), where he was responsible for the budget formulation and execution processes of all DoN DBOF activities, which includes the RDT&E activities, shipyards, aviation depots, ordnance centers, and supply centers.

Mr. Therning was appointed Head, Financial Management Division/Comptroller of NRL in July 1996. Since that time, his responsibilities have increased in the Business Operations Directorate. In October 1996, in addition to leading the Financial Management Division, he assumed responsibilities for the Management Information Systems office. In January 1999, as an additional duty to his role as Comptroller, Mr. Therning was appointed to the newly established position of Deputy Associate Director of Research for Business Operations to assist in the management and administration of the Business Operations Directorate.

Mr. Therning was Acting Associate Director of Research for Business Operations from April 1999 until March 2000, when he was appointed the Associate Director of Research for Business Operations.




## Key Personnel

| Name | Title | Code |
|---|---|---|
| Mr. D.K. Therning | Associate Director of Research for Business Operations | 3000 |
| Vacant | Special Assistant | 3001 |
| Ms. T. Horsey | Deputy for Small Business | 3005 |
| Ms. P.W. Lowery | Head, Management Information Systems Office | 3030 |
| Mr. J.C. Ely | Head, Contracting Division | 3200 |
| Mr. E.J. Stone | Head, Financial Management Division | 3300 |
| Ms. C.A. Hartman | Head, Supply and Information Services Division | 3400 |
| Mr. T.K. Hull, Jr. | Director, Research and Development Services Division | 3500 |

**Point of contact:** Code 3000A, (202) 404-7461

# Contracting Division

## Code 3200
## Staff Activity Areas

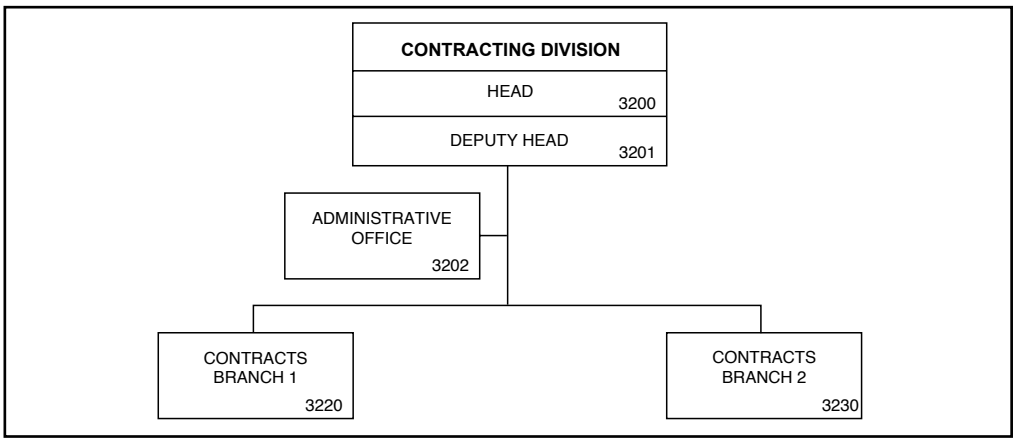
- Advance Acquisition Planning
- Acquisition Strategies
- Acquisition Training
- Contract Negotiations
- Contractual Execution
- Contract Administration

Specialist, Administrative Officer, and Deputy for Small Business attend staff meeting.

Contracting personnel attend training session.


Contract specialists review contract file.

Specialist and Division Head discuss small business programs with Deputy for Small Business.




## Basic Responsibilities

The Contracting Division is responsible for the acquisition of major research and development materials, services, and facilities where the value is in excess of $100,000. It also maintains liaison with the ONR Procurement Directorate on procurement matters involving NRL. Specific functions include: providing consultant and advisory services to NRL division personnel on acquisition strategy, contractual adequacy of specifications, and potential sources; reviewing procurement requests for accuracy and completeness; initiating and processing solicitations for procurement; awarding contracts; performing contract administration and post-award monitoring of contract terms and conditions, delivery, contract changes, patents, etc., and taking corrective actions as required; providing acquisition-related training to division personnel; and interpreting and implementing acquisition-related Federal Department of Defense and Navy regulations.

**Personnel:** 30 full-time civilian

## Key Personnel

| Title | Code |
|---|---|
| Head, Contracting Division | 3200 |
| Deputy Head | 3201 |
| Administrative Officer | 3202 |
| Head, Contracts Branch 1 | 3220 |
| Head, Contracts Branch 2 | 3230 |
| Head, Contracts Section, SSC | 3235 |

**Point of contact:** Code 3202, (202) 767-3749

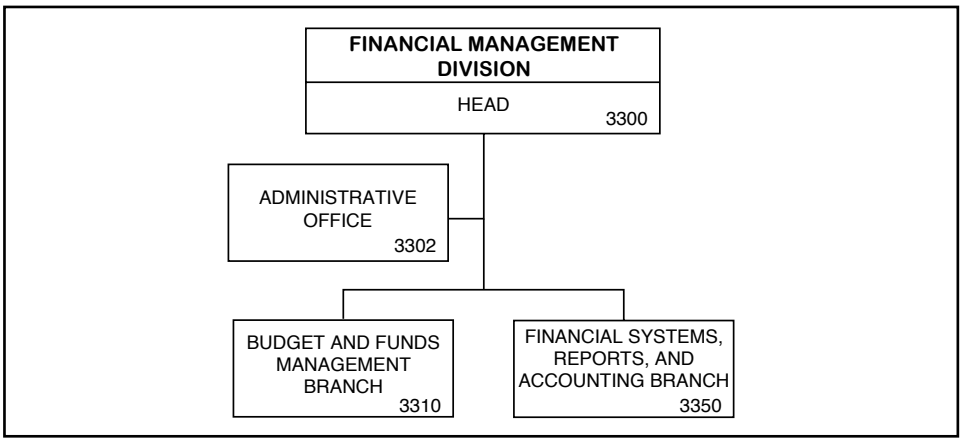
# Financial Management Division

## Code 3300
## Staff Activity Areas

- Budget
- Reports and Statistics
- Accounting
- Travel Services
- Payroll Liaison

The Budget Branch prepares various financial analyses, reports, and studies in response to external data calls and/or management requests.

The Financial Systems, Reports, and Accounting Branch ensures that NRL's financial system satisfies user requirements and is in compliance with applicable rules and regulations, maintains official accounting records, and coordinates efforts with DFAS to complete payment transactions related to NRL business.




## Basic Responsibilities

The Financial Management Division (FMD) develops, coordinates, and maintains an integrated system of financial management that provides the Comptroller, Commanding Officer, Director of Research, and other officials of NRL the information and support needed to fulfill the financial and resource management aspects of their responsibilities. FMD translates the NRL program requirements into the financial plan, formulates the NRL budget, monitors and evaluates performance with the budget plan, and provides recommendations and advice to NRL management for corrective actions or strategic program adjustments. FMD maintains the accounting records of NRL's financial and related resources transactions and prepares reports, financial statements, and other documents in support of NRL management needs and/or to comply with external reporting requirements. FMD provides financial management guidance, policies, advice, and documented procedures to ensure that NRL operates in compliance with Navy and DoD regulations and with economy and efficiency. FMD coordinates efforts with the Defense Finance and Accounting Service (DFAS) to complete payment transactions related to NRL business (e.g., the payment of NRL personnel for payroll and travel expenses and the payment to NRL's contractors and vendors for goods and services purchased by NRL). Additionally, FMD develops, operates, and maintains automated business and management information systems supporting the lab-wide administrative and business processes, including financial management, procurement and contracting, stores and inventory, asset management, human resources, facilities, and security.

**Personnel:** 68 full-time civilian

### Key Personnel

| Title | Code |
|---|---|
| Head, Financial Management Division | 3300 |
| Administrative Officer | 3302 |
| Head, Budget and Funds Management Branch | 3310 |
| Head, Corporate Budget Unit | |
| Head, Internal Budget Unit | |
| Head, Financial Systems, Reports, and Accounting Branch | 3350 |
| Head, Cost Accounting Section | 3351 |
| Head, Contracts and Credit Cards Unit | 3351.1 |
| Head, Small Purchases Unit | 3351.2 |
| Head, Financial Services Section | 3352 |
| Head, Payroll Services Unit | 3352.1 |
| Head, Travel Services Unit | 3352.2 |
| Head, Asset Management Unit | 3352.3 |
| Head, Accounting Systems and Reports | 3353 |

**Point of contact:** Code 3302, (202) 767-2950

# Supply and Information Services Division

## Code 3400
## Staff Activity Areas

- Purchasing
- Technical Information Services
- Customer Support and Program Management
- Material Control
- Administrative Services
- Automated Inventory Management System
- Disposal and Storage
- Store Material Issues

Head of the Small Purchase Section reviews purchase order.

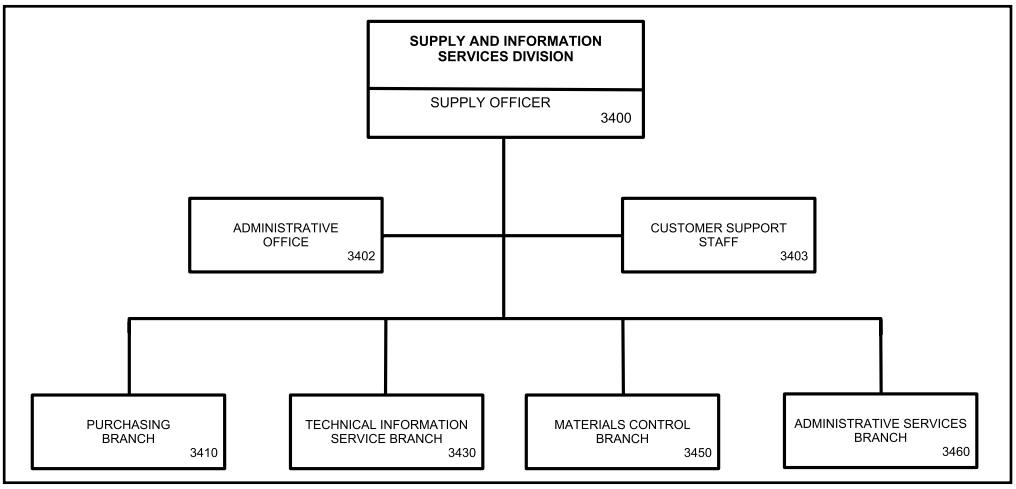

Customers and employee at the Supply store.

Woodworkers prepare boxes for shipping.

Disposal and Storage in Building 49.

Mail clerks sort mail by directorate and file into bins by organizational codes. Mail is bundled and delivered once a day.

The Publications staff discusses design ideas for a new publication.




## Basic Responsibilities

The Supply and Information Services Division provides the Laboratory and its field activities with contracting, supply management, logistics, administrative, and technical information services. Specific functions include: procuring required equipment, material, and services; receiving, inspecting, storing, and delivering material and equipment; packing, shipping, and traffic management; surveying and disposing of excess and unusable property; operating various supply issue stores and performing stock inventories; providing technical and counseling services for the research directorates in the development of specifications for a complete procurement package; and obtaining and providing guidance in the performance stages of contractual services. Services also include publications, visual information, exhibits, photography, editing, and mailroom services and correspondence management.

**Personnel:** 102 full-time civilian

## Key Personnel

| Title | Code |
|---|---|
| Supply Officer | 3400 |
| Administrative Officer | 3402 |
| Head, Customer Support Staff | 3403 |
| Head, Purchasing Branch | 3410 |
| Head, Technical Information Services Branch | 3430 |
| Head, Materials Control Branch | 3450 |
| Head, Administrative Services Branch | 3460 |

**Point of contact:** Code 3402, (202) 404-1701

# Research and Development Services Division

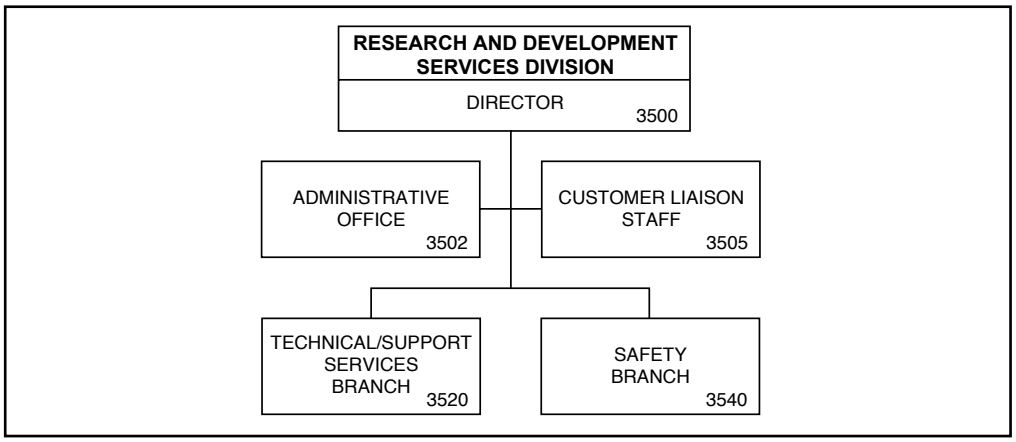
## Code 3500
## Staff Activity Areas

- Technical/Support Services
- Production Control
- Shop Services
- Chesapeake Bay Section
- Customer Liaison
- Safety
- Environmental
- Health Physics
- Administrative Office
- Telephones

Telephone Office – processing service calls

Service Desk – processing service calls

Machine Shop – fabricating radar pedestal for shipboard operation




## Basic Responsibilities

The Research and Development Services Division is responsible for the physical plant of the Naval Research Laboratory and subordinate field sites. The responsibilities include military construction, engineering, and coordination of construction; facility support services, planning, maintenance/repair/operation of all infrastructure systems; transportation; and occupational safety, health and industrial hygiene, and environmental safety.

The Division provides engineering and technical assistance to research divisions in the installation and operation of critical equipment in support of the research mission.

**Personnel:** 134 full-time civilian

## Key Personnel

| Title | Code |
|---|---|
| Director, Research and Development Services Division | 3500 |
| Administrative Officer | 3502 |
| Head, Customer Liaison Staff | 3505 |
| Head, Technical/Support Services Branch | 3520 |
| Head, Engineering Section | 3521 |
| Head, Chesapeake Bay Section | 3522 |
| Head, Shop Services Section | 3523 |
| Head, Production Control Section | 3524 |
| Head, Safety Branch | 3540 |
| Occupational Safety and Health/Industrial Hygiene | 3541 |
| Explosives Safety | 3542 |
| Health Physics | 3544 |
| Environmental | 3546 |

**Point of contact:** Code 3502, (202) 404-4312

# Systems Directorate

# SYSTEMS DIRECTORATE

## Code 5000

The Systems Directorate applies the tools of basic research, concept exploration, and engineering development to expand operational capabilities and to provide materiel support to Fleet and Marine Corps missions. Emphasis is on technology, devices, systems, and know-how to acquire and move war-fighting information and to deny these capabilities to the enemy. Current activities include:

- New and improved radar systems to detect and identify ever smaller targets in the cluttered littoral environment;
- Optical sensors and related materials to extract elusive objects in complex scenes when both processing time and communications bandwidth are limited;
- Unique optics-based sensors for detection of biochemical warfare agents and pollutants, for monitoring structures, and for alternative sensors;
- Advanced electronic support measures techniques for signal detection and identification;
- Electronic warfare systems, techniques, and devices including quick-reaction capabilities;
- Innovative concepts and designs for reduced observables;
- Techniques and devices to disable and/or confuse enemy sensors and information systems;
- Small "intelligent"/autonomous land, sea, or air vehicles to carry sensors, communications relays, or jammers; and
- High performance/high assurance computers with right-the-first-time software and known security characteristics despite commercial off-the-shelf components and connections to public communications media.

Many of these efforts extend from investigations at the frontiers of science to the support of deployed systems in the field, which themselves provide direct feedback and inspiration for applied research and product improvement and/or for quests for new knowledge to expand the available alternatives.

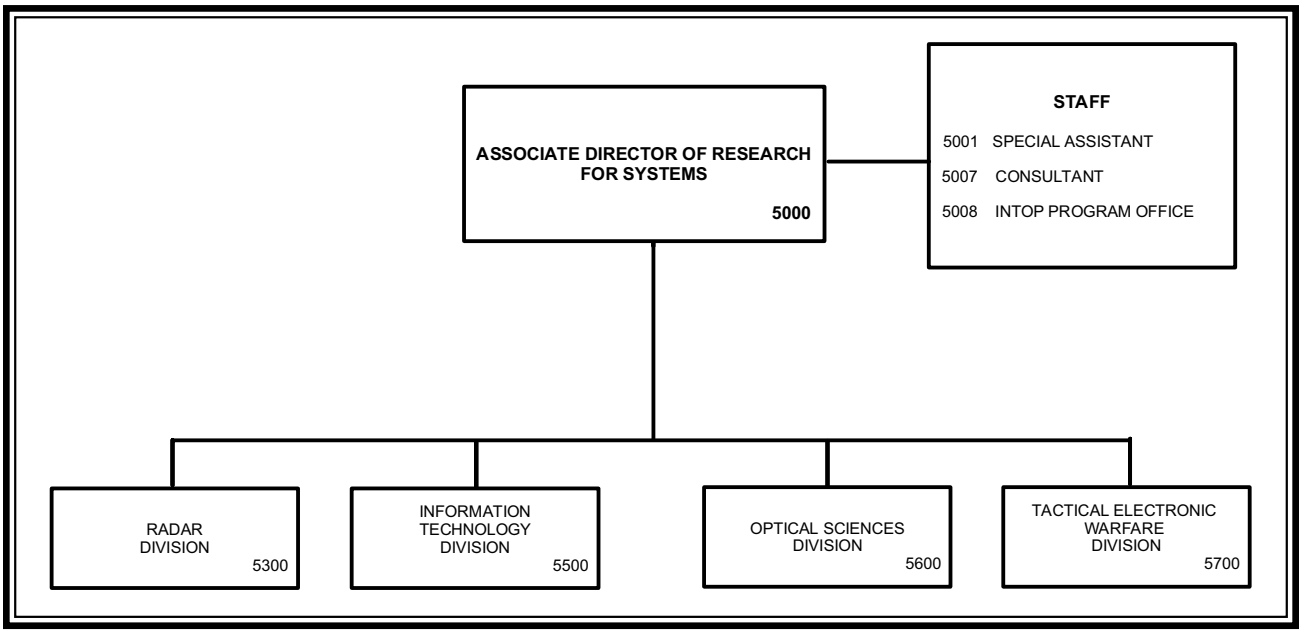
In addition to its wide-ranging multidisciplinary research program, the Directorate provides support to the corporate laboratory in shared resources for high performance computing and networking, technical information collection and distribution, and in coordination of Laboratory-wide efforts in signature technology, countersignature technology, Theater Missile Defense, and the Naval Science Assistance Program.

# Associate Director of Research for Systems

**Dr. G.M. Borsuk** is the Associate Director of Research for Systems at the Naval Research Laboratory (NRL) in Washington, DC. In this position he provides executive direction and leadership to four major NRL research divisions that conduct a broad multidisciplinary program of scientific research and advanced technological development in the areas of optics, electromagnetics, information technology, and radar. He is responsible for the conduct and effectiveness of research programs conducted within these divisions and for the overall administration of activities throughout the Systems Directorate. He is also the Focus Area Coordinator for all NRL base programs in electronics science and technology. Prior to this appointment, Dr. Borsuk served for 23 years as the Superintendent of the Electronics Science and Technology Division at NRL where he was responsible for the in-house execution of a multidisciplinary program of basic and applied research in electronic materials and structures, solid state devices, vacuum electronics, and circuits. Dr. Borsuk serves as the Office of Naval Research (ONR) representative for electronics basic research to the Office of the Secretary of Defense and is the Navy member to the Tri-Service Scientific Planning Group for Electronics. He was the Navy Deputy Program Manager and Technical Director for the now completed DARPA/Tri-Service MIMIC and MAFET Programs. He was the Department of Defense (DoD) technical representative for Electronics to the Wassenaar Arrangement dealing with export control. He has also served as the DoD representative to the President's National Science and Technology Council's Electronic Materials Working Group.

Dr. Borsuk joined the ITT Electro-Physics Laboratory in Columbia, Maryland, as a staff physicist in 1973, where he worked on the application of charge-coupled devices (CCDs) for imaging and signal processing. In 1976 he joined the Westinghouse Advanced Technology Laboratory in Baltimore, Maryland, developing advanced silicon VLSI integrated circuits and performing device physics research. He performed original work in the design and fabrication of CCDs for signal processing and photodetectors for use with acousto-optic signal processors. He headed the Westinghouse VHSIC effort in advanced sub-micron VLSI device technology. Dr. Borsuk was department manager of Solid State Sciences at the Advanced Technology Laboratory when he left Westinghouse in 1983 to join the Naval Research Laboratory as the Superintendent of the Electronics Science and Technology Division.

Dr. Borsuk received a Ph.D. in physics from Georgetown University in Washington, DC, in 1973. He is a Fellow of the IEEE, a member of the American Physical Society, a member of the AVS, a member of Sigma Xi, and the Navy's Deputy Member to the Advisory Group on Electron Devices (AGED). He has 37 technical publications, four patents, and eleven invention disclosures. He is the recipient of three Presidential Rank Senior Executive Awards, the most recent awarded in 2005. He is also the recipient of the IEEE Frederik Philips Award, the IEEE Harry Diamond Memorial Award, the IEEE Millennium Medal, and an IR-100 Award for his work on high speed CCDs. Dr. Borsuk also served on the editorial board of the IEEE Proceedings.




## Key Personnel

| Name | Title | Code |
|---|---|---|
| Dr. G.M. Borsuk | Associate Director of Research for Systems | 5000 |
| Ms. B.L. Murphy | Special Assistant | 5001 |
| Dr. M.I. Skolnik | Consultant | 5007 |
| Mr. G.C. Tavik | Head, InTop Program Office | 5008 |
| Dr. B.G. Danly | Superintendent, Radar Division | 5300 |
| Dr. J.D. McLean | Superintendent, Information Technology Division | 5500 |
| Dr. R.G. Driggers | Superintendent, Optical Sciences Division | 5600 |
| Dr. F.J. Klemm | Superintendent, Tactical Electronic Warfare Division | 5700 |

**Point of contact:** Code 5000A, (202) 767-3324

# Radar Division

## Code 5300
## Staff Activity Areas

AEGIS coordination
Marine Corps/IFF coordination
Maritime Domain Awareness
Electromechanical design
Multifunction RF systems
Asymmetric warfare
High-power millimeter-wave radar
Digital array radar

## Research Activity Areas

### Radar Analysis

Target signature prediction
Electromagnetics and antennas
Airborne early-warning radar (AEW)
Inverse synthetic aperture radar (ISAR)
Space-time adaptivity
In situ array calibration

### Advanced Radar Systems

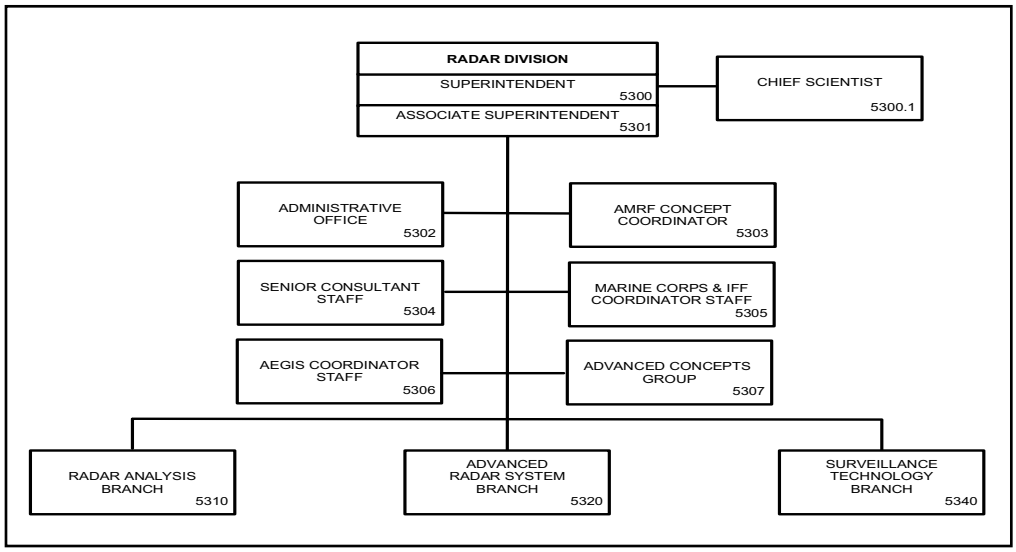
High-frequency over-the-horizon radar
Signal analysis
Real-time signal processing and equipment
Computer Aided Engineering (CAE)
Electromagnetic Compatibility (EMC)
Electromagnetic Interference (EMI)
Mark XII IFF improvements
Future identification technology

### Surveillance Technology

Shipboard surveillance radar
Ship self-defense
Electronic counter-countermeasures
Target signature recognition
Digital T/R modules
Sea clutter characterization
Ultrawideband technology
Dynamic waveform diversity
Information extraction
Ballistic missile defense
Mine detection

Wavelength Scaled Array: An Ultra-Wideband Array Concept providing constant beamwidth across 8:1 bandwidth; designed by NRL developed Domain Decomposition Algorithm.

The Advanced Multifunction RF Concept (AMRFC) test-bed as a proof-of-principle demonstration system capable of simultaneously transmitting and receiving multiple beams from common transmit and receive array antennas for radar, electronic warfare, and communications.




## Basic Responsibilities

The Radar Division conducts research on basic physical phenomena of importance to radar and related sensors, investigates new engineering techniques applicable to radar, demonstrates the feasibility of new radar concepts and systems, performs related systems analyses and evaluation of radar, and provides special consultative services. The emphasis is on new and advanced concepts and technology in radar and related sensors that are applicable to enhancing the Navy's ability to fulfill its mission.

**Personnel:** 94 full-time civilian

## Key Personnel

| Title | Code |
|---|---|
| Superintendent, Radar Division | 5300 |
| Associate Superintendent | 5301 |
| Administrative Officer | 5302 |
| Senior Consultant Staff | 5304 |
| Marine Corps and IFF Coordinator | 5305 |
| AEGIS Coordinator | 5306 |
| Head, Advanced Concepts Group | 5307 |
| Head, Radar Analysis Branch | 5310 |
| Head, Advanced Radar Systems Branch | 5320 |
| Head, Surveillance Technology Branch | 5340 |

**Point of contact:** Code 5300, (202) 404-2700

# Information Technology Division

## Code 5500
## Research Activity Areas

### Freespace Photonics Communications Office
- Extended spectrum communications
- Atmospheric channel effects on photonic transfer
- Studies in marine miraging
- Analog modulation techniques on freespace optical carriers
- Modulating retroreflector based communications
- Signature studies for ISR
- Adaptive optics for freespace optical communications

### Adversarial Modeling and Exploitation Office
- Hostile Intent and Deception Detection
- Deception Algorithm Research
- Geospatial Modeling and Simulation
- Human Geography
- Behavioral Analysis and Metrics
- Spatially Integrated Social Science
- Integrated Intelligence, Surveillance, and Reconnaissance
- Automated Video Analysis and Retrieval

### Navy Center for Applied Research in Artificial Intelligence
- Intelligent decision aids
- Natural language and multimodal interfaces
- Intelligent software agents
- Machine learning and adaptive systems
- Robotics software and computer vision
- Neural networks
- Novel devices/techniques for HCI
- Spatial audio
- Immersive simulation
- Autonomous and intelligent systems
- Case-based reasoning and problem solving methods
- Machine translation technology evaluation
- Cognitive Architectures
- Human-robot interaction

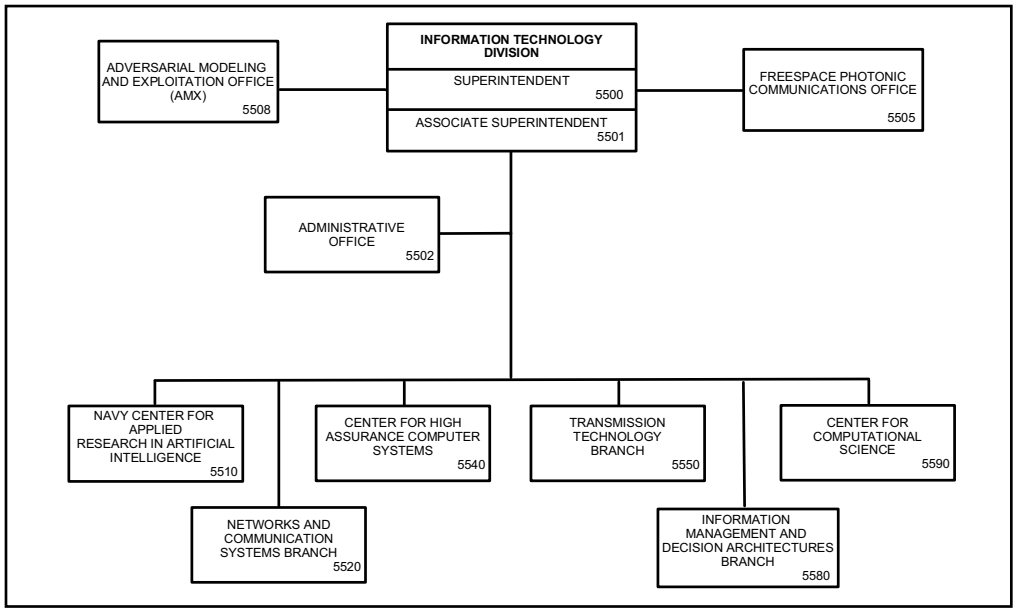
### Transmission Technology
- Communication system architecture
- Communication antenna/propagation technology
- Communications intercept systems
- Virtual engineering
- Secure voice technology

### Center for High Assurance Computer Systems
- Secure service oriented architectures (SOA) and Secure Enterprise Architectures (SEA)
- Formal specification/verification of system security
- COMSEC application technology
- Technology and solutions to secure networks and databases
- Software engineering for secure systems
- Key management and distribution solutions
- Certification and Accreditation (C&A) methodologies and practices
- Information Systems Security (INFOSEC) Engineering
- Formal methods for requirements specification and verification
- Security product development
- Secure wireless network and wireless sensor technology
- Network security protocol modeling and simulation

### Networks and Communication Systems
- Communication system engineering
- Mobile, wireless networking technology
- Bandwidth management (quality of service)
- Joint service tactical networking
- Integration of communication and C2 applications
- Automated testing of highly mobile tactical networks
- Reliable multicast protocols and applications
- Communication network simulation
- Networking protocols for directional antennas
- Policy-based network management
- Tactical voice-over IP
- Sensor networks
- Advanced Tactical Data Links
- Cognitive Radio Technology

### Center for Computational Science
- Transparent optical network research and design
- Parallel computing
- Scalable high performance computing for Navy and DoD
- Distributed computing environments
- Scientific visualization
- Advanced networking streams
- High-definition video technology
- End user support for information technology and operational networks
- Lab-wide support for web, email, and other information services
- Testbed for Global Information Grid

### Ruth H. Hooker Research Library
- Desktop/workbench access to nearly all-relevant scientific resources
- NRL scientific digital archive (TORPEDO Ultra)
- Authoritative database of NRL-produced publications (Online Bibliography)
- Comprehensive literature/citation/classified searches
- Extensive collection of print-based books, journals, and technical reports




## Basic Responsibilities

The Information Technology Division conducts research and development programs in the collection, transmission, processing, distribution, and presentation of information to provide a basis for improving military operations, with a focus on Network Centric Warfare. The organization of the Division is directed toward addressing the technologies, architectures, and subsystems necessary to develop future warfare systems and next-generation command, control, communication, computer, intelligence, surveillance, and reconnaissance systems.

**Personnel:** 204 full-time civilian

### Key Personnel

| Title | Code |
|---|---|
| Superintendent/NRL Chief Information Officer | 5500 |
| Associate Superintendent | 5501 |
| Administrative Officer | 5502 |
| Head, Freespace Photonics Communications Office | 5505 |
| Head, Adversarial Modeling and Exploitation Office | 5508 |
| Director, Navy Center for Applied Research in Artificial Intelligence | 5510 |
| Head, Networks and Communication Systems Branch | 5520 |
| Director, Center for High Assurance Computer Systems | 5540 |
| Head, Transmission Technology Branch | 5550 |
| Head, Information Management and Decision Architectures Branch | 5580 |
| Director, Center for Computational Science | 5590 |
| Chief Librarian, Ruth H. Hooker Research Library | 5596 |

**Point of contact:** Code 5501, (202) 767-2954

# Optical Sciences Division

## Code 5600
## Staff Activity Areas

Program analysis and development
Special systems analysis
Technical study groups
Technical contract monitoring
Theoretical studies

## Research Activity Areas

### Optical Materials and Devices
Advanced infrared optical materials
IR fiber-optic materials and devices
IR fiber chemical and environmental sensors
IR transmitting windows and domes
Transparent ceramic armor materials
Planar waveguide devices
IR nonlinear materials and devices
Laser gain ceramic materials solar cells

### Optical Physics
Laser materials diagnostics
Nonlinear frequency conversion
Optical instrumentation and probes
Optical interactions in semiconductor superlattices and organic solids
Laser-induced reactions
Organic light-emitting devices
Nano-optical and electrical research

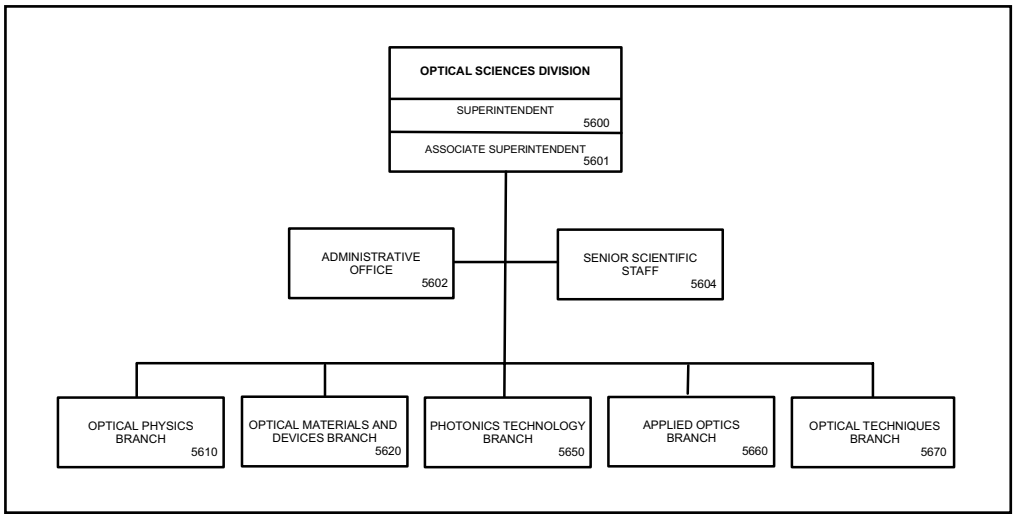
### Applied Optics
Optical and IR countermeasures
Ultraviolet component development and UV countermeasures
Missile warning sensor technology
UV, visible, and IR imager development
Multispectral sensors and processing
Framing reconnaissance sensors
Novel optical components
Sensor Control and Exploitation System Development
Detection signal processing algorithm development
IR Range Facility
IR low observables
Multispectral/hyperspectral/detection algorithms
EO/IR systems analysis
Atmospheric IR measurements
Ship IR signatures
Airborne IR search and track technology

### Photonics Technology
Fiber and solid-state laser/sources
High-speed (<100 fs) optical probing
High-power fiber amplifiers
High-speed fiber-optic communications
Antenna remoting
Free space communication
Photonic control of phased arrays
Optical clocks
Microwave photonics

### Optical Techniques
Radiation effects
Fiber lasers/sources and amplifiers
Fiber-optic materials and fabrication
Fiber Bragg grating sensors/systems for smart structures
Fiber-optic sensors/systems (acoustic, magnetic, gyroscopes)
Integrated optics
Optical sources for sensors

Fiber Fabrication Facility for Nonoxide and Specialty Glasses. Unique state-of-the-art draw tower used for fabricating infrared transmitting fiber from specialty glasses under controlled atmospheres using NRL-invented preform and double crucible processes.

The infrared countermeasure (IRCM) Techniques Laboratory provides a comprehensive test bed for all types of infrared (IR) countermeasures against a variety of IR threats. The facility includes advanced countermeasure sources for the testing of advanced CM systems and a two-color multiflare/expendable hardware simulator for testing advanced expendable techniques against multispectral threats. The laboratory also has an extensive modeling and simulation capability for testing of IRCM against both reticle-based and IR focal plane array-based missile seekers.




## Basic Responsibilities

The Optical Sciences Division carries out a variety of research, development, and application-oriented activities in the generation, propagation, detection, and use of radiation in the wavelength region between near-ultraviolet and far-infrared wavelengths. The research, both theoretical and experimental, is concerned with discovering and understanding the basic physical principles and mechanisms involved in optical devices, materials, and phenomena. The development effort is aimed at extending this understanding in the direction of device engineering and advanced operational techniques. The applications activities include systems analysis, prototype system development, and exploitation of R&D results for the solution of optically related military problems. In addition to its internal program activities, the Division serves the Laboratory specifically and the Navy generally as a consulting body of experts in optical sciences. The work in the Division includes studies in quantum optics, laser physics, optical waveguide technologies, laser-matter interactions, atmospheric propagation, optical technology, holography, optical warfare, optical data processing, fiber-optic sensor systems, optical systems, optical materials, radiation damage studies, IR surveillance and missile seeker technologies, IR signature measurements, optical recording materials, and optical diagnostic techniques. A significant portion of the effort is devoted to developing, analyzing, and using special optical materials. Various field measurement programs on optical problems of specific interest are also conducted.

**Personnel:** 137 full-time civilian

### Key Personnel

| Title | Code |
|---|---|
| Superintendent, Optical Sciences Division | 5600 |
| Associate Superintendent | 5601 |
| Administrative Officer | 5602 |
| Head, Senior Scientific Staff | 5604 |
| Head, Optical Physics Branch | 5610 |
| Head, Optical Materials and Devices Branch | 5620 |
| Head, Photonics Technology Branch | 5650 |
| Head, Applied Optics Branch | 5660 |
| Head, Optical Techniques Branch | 5670 |

**Point of contact:** Code 5602, (202) 767-6986

# Tactical Electronic Warfare Division

## Code 5700
## Staff Activity Areas

EW Strategic Planning
Signature Technology Office
Effectiveness of Naval EW Systems (ENEWS)
EW Lead Lab Coordinator

## Research Activity Areas

### Offboard Countermeasures
Expendable technology and devices
Unmanned air vehicles
Offboard payloads
Decoys

### Airborne Electronic Warfare Systems
Air systems development
Penetration aids
Power source development
Jamming and deception
Millimeter-wave technology
Communications CM

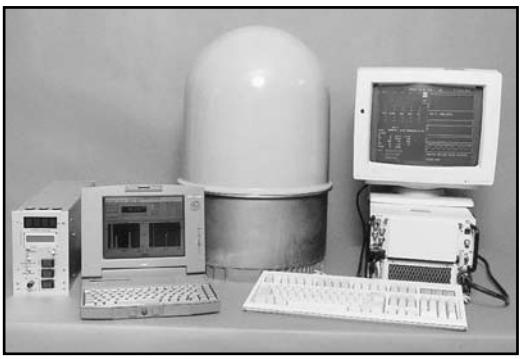
### Ships Electronic Warfare Systems
Ships systems development
Jamming technology
Deception techniques
EW antennas

### Electronic Warfare Support Measures
Intercept systems and direction finders
RF signal simulators
Systems integration
Command and control interfaces
Signal processing

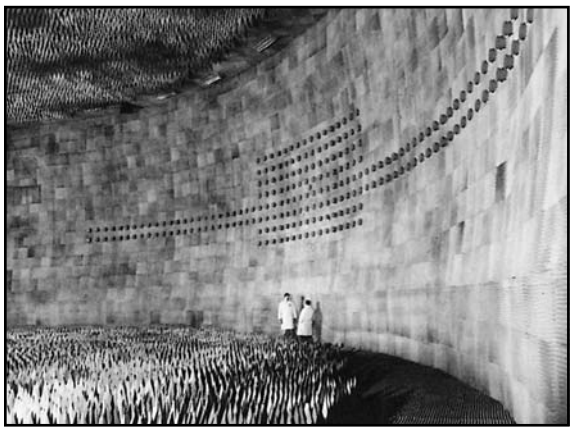
### Advanced Techniques
Analysis and modeling simulation
New EW techniques
Experimental systems
EW concepts
Infrared technology

### Integrated EW Simulation
Hardware-in-the-loop simulation
Data management technology
Flyable ASM seeker simulators
Foreign military equipment exploitation

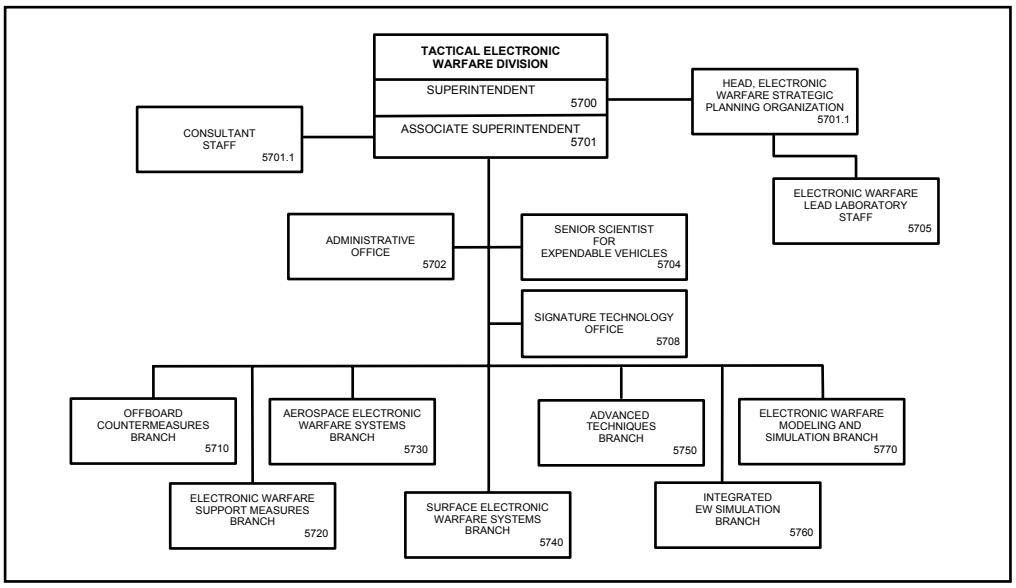
### EW Modeling and Simulation
High fidelity threat models and simulations
Advanced system visualization
EW tactical decision aids
RF environmental and propagation modeling



Using the latest composite, MMIC, and processing technologies, the Tactical Electronic Warfare Division has developed a small, lightweight, and inexpensive ESM receiving system for use on frigates, Coast Guard vessels, and various patrol aircraft



The Central Target Simulator (CTS) Programmable Array is part of a large hardware-in-the-loop simulation facility whose purpose is to test and evaluate electronic warfare systems and techniques used to counter the radar guided missile threat to Navy forces




## Basic Responsibilities

The Tactical Electronic Warfare Division (TEWD) is responsible for research and development in support of the Navy's tactical electronic warfare requirements and missions. These include electronic warfare support measures, electronic countermeasures, and supporting counter-countermeasures, as well as studies, analyses, and simulations for determining and improving the effectiveness of these systems.

**Personnel:** 237 full-time civilian

## Key Personnel

| Title | Code |
|---|---|
| Superintendent, Tactical Electronic Warfare Division | 5700 |
| Head, Electronic Warfare Strategic Planning Organization | 5700.1 |
| Associate Superintendent | 5701 |
| Administrative Officer | 5702 |
| Senior Scientist for Expendable Vehicles | 5704 |
| Head, Electronic Warfare Lead Laboratory Staff | 5705 |
| Head, Signature Technology Office | 5708 |
| Head, Offboard Countermeasures Branch | 5710 |
| Head, Electronic Warfare Support Measures Branch | 5720 |
| Head, Aerospace Electronic Warfare Systems Branch | 5730 |
| Head, Surface Electronic Warfare Systems Branch | 5740 |
| Head, Advanced Techniques Branch | 5750 |
| Head, Integrated Electronic Warfare Simulation Branch | 5760 |
| Head, Electronic Warfare Modeling and Simulation Branch | 5770 |

**Point of contact:** Code 5701, (202) 767-5974

# Materials Science and Component Technology Directorate

# MATERIALS SCIENCE AND COMPONENT TECHNOLOGY DIRECTORATE

## Code 6000

The Materials Science and Component Technology Directorate carries out a multidisciplinary research program whose objectives are the discovery, invention, and exploitation of new improved materials, the generation of new concepts associated with materials behavior, and the development of advanced components based on these new and improved materials and concepts. Theoretical and experimental research is carried out to determine the scientific origins of materials behavior and to develop procedures for modifying these materials to meet important naval needs for advanced platforms, electronics, sensors, and photonics. The program includes investigations of a broad spectrum of materials including insulators, semiconductors, superconductors, metals and alloys, optical materials, polymers, plastics, and artificially structured bio/molecular materials, composites, microbial effects on material degradations and transformations and energetic materials which are used in important naval devices, components, and systems. New techniques are developed for producing, processing, and fabricating these materials for crucial naval applications.

The synthesis, processing, properties, and limits of performance of these new and improved materials in natural or radiation environments, and under deleterious conditions such as those associated with the marine environment, neutron or directed energy beam irradiation, or extreme temperatures and pressures, are established. For new materials design, emphasis is placed on protection of the environment.

Additionally, major thrusts are directed in advanced sensing, detection, reactive flow physics, computational physics, and plasma sciences. Areas of particular emphasis include nanoscience and technology, fluid mechanics and hydrodynamics, nuclear weapon effects simulations, high-energy density materials including fuels, propellants, explosives, and storage devices, interactions of various types of radiation with matter, survivability of materials and components, and directed energy devices.

# Associate Director of Research for Materials Science and Component Technology

**Dr. B.B. Rath** was born in Banki, India. He received a B.S. degree in physics and mathematics from Utkal University, an M.S. in metallurgical engineering from Michigan Technological University, and a Ph.D. from the Illinois Institute of Technology.

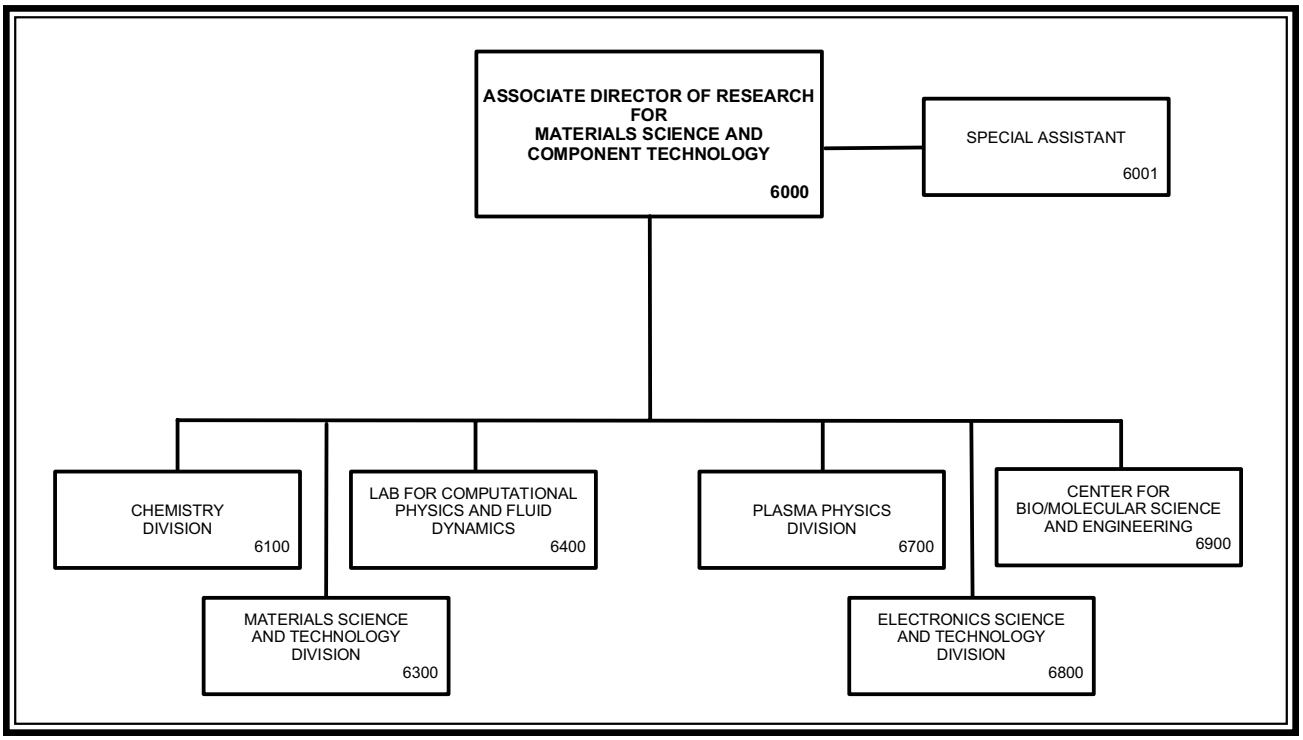
Dr. Rath was Assistant Professor of Metallurgy and Materials Science at Washington State University from 1961 to 1965. From 1965 to 1972, he was with the staff of the Edgar C. Bain Laboratory for fundamental research of the U.S. Steel Corporation. From 1972 to 1976, he headed the Metal Physics Research Group of the McDonnell Douglas Research Laboratories in St. Louis, Missouri, until he came to NRL as Head of the Physical Metallurgy Branch. During this period, he was adjunct professor at Carnegie-Mellon University, the University of Maryland, and the Colorado School of Mines. Dr. Rath served as Superintendent of the Materials Science and Technology Division from 1982 to 1986, when he was appointed to his present position.

Dr. Rath is recognized in the fields of solid-state transformations, grain boundary migrations, and structure-property relationships in metallic systems. He has published over 140 papers in these fields and edited several books and conference proceedings.

Dr. Rath serves on several planning, review, and advisory boards for both the Navy and the Department of Defense, as well as for the National Materials Advisory Board of the National Academy of Sciences, National Science Foundation, University of Virginia, Colorado School of Mines, and the University of Florida. He is currently the Navy representative to the DOE Deputy Assistant Secretary's advisory and planning committee on methane hydrates, and the Navy representative to the Indo-U.S. Joint Commission on Science and Technology. He previously served as the Navy representative to the panel of The Technical Cooperation Program (TTCP) countries .

Dr. Rath is a member of the National Academy of Engineering. He is a fellow of the Minerals, Metals and Materials Society (TMS), American Society for Materials-International (ASM), Washington Academy of Sciences, Materials Research Society of India, and the Institute of Materials of the United Kingdom. In 2007, Dr. Rath received an honorary doctorate in engineering from the Michigan Technological University and was elected to deliver the commencement address to the 2007 graduating class. In 2008, he received the Illinois Institute of Technology Mechanical Materials & Aerospace Engineering Department 2008 Alumni Recognition Award.

Dr. Rath has received a number of honors and awards, most recently the Padma Bhushan Award of Honors and Excellence bestowed by the President of India and the Acta Materialia J. Herbert Hollomon Award. His other awards include the DOD Distinguished Civilian Service Award which is presented by the Secretary of Defense for distinguished accomplishments and sustained superior service, the 2005 Fred Saalfeld Award for Outstanding Lifetime Achievement in Science, the Presidential Rank Award for Distinguished Executive (2005), the NRL Lifetime Achievement Award (2004), National Materials Advancement Award from the Federation of Materials Societies (2001), the Presidential Rank of Meritorious Executive Award (1999 and 2004), the S. Chandrasekhar Award and Medal, and the Award of Merit for Group Achievement from the Chief of Naval Research. He received the 1991 George Kimball Burgess Memorial Award, the Charles S. Barrett Medal, and the prestigious TMS Leadership Award for his contributions to Materials Research. The American Society for Materials International and The Metals, Minerals, and Materials Society have jointly recognized him with the TMS/ASM Joint Distinguished Lectureship in Materials & Society Award and the 2001 ASM Distinguished Life Membership Award. He has served as the 2004-2005 President of the American Society for Materials. He also has served as a member of the Boards of Directors/Trustees of TMS, ASM-International, and the Federation of Materials Society (FMS), as a member of the editorial boards of three international materials research journals, and as chairman of several committees of TMS, ASM, FMS, and American Association of Engineering Societies.




## Key Personnel

| Name | Title | Code |
|---|---|---|
| Dr. B.B. Rath | Associate Director of Research for Materials Science and Component Technology | 6000 |
| Mr. S.J. Gill | Special Assistant | 6001 |
| Dr. R.J. Colton | Superintendent, Chemistry Division | 6100 |
| Dr. D.U. Gubser | Superintendent, Materials Science and Technology Division | 6300 |
| Dr. J.P. Boris | Chief Scientist and Director, Laboratory for Computational Physics and Fluid Dynamics | 6400 |
| Dr. T.A. Mehlhorn | Superintendent, Plasma Physics Division | 6700 |
| Dr. B.V. Shanabrook | Superintendent, Electronics Science and Technology Division | 6800 |
| Dr. B.R. Ratna | Director, Center for Bio/Molecular Science and Engineering | 6900 |

**Point of contact:** Code 6000, (202) 767-2538

# Chemistry Division

## Code 6100
## Research Activity Areas

### Chemical Diagnostics
- Optical diagnostics of chemical reactions
- Kinetics of gas phase reactions
- Trace analysis
- Atmosphere analysis and control
- Ion/molecule processes
- Environmental chemistry/microbiology
- Methane hydrates
- Laboratory on a chip
- Alternate energy sources

### Materials Chemistry
- Synthesis and evaluation of innovative polymers
- Functional organic coatings
- Polymer characterization
- Magnetic resonance
- Degradation and stabilization mechanisms
- High-temperature resins
- Bio-inspired materials

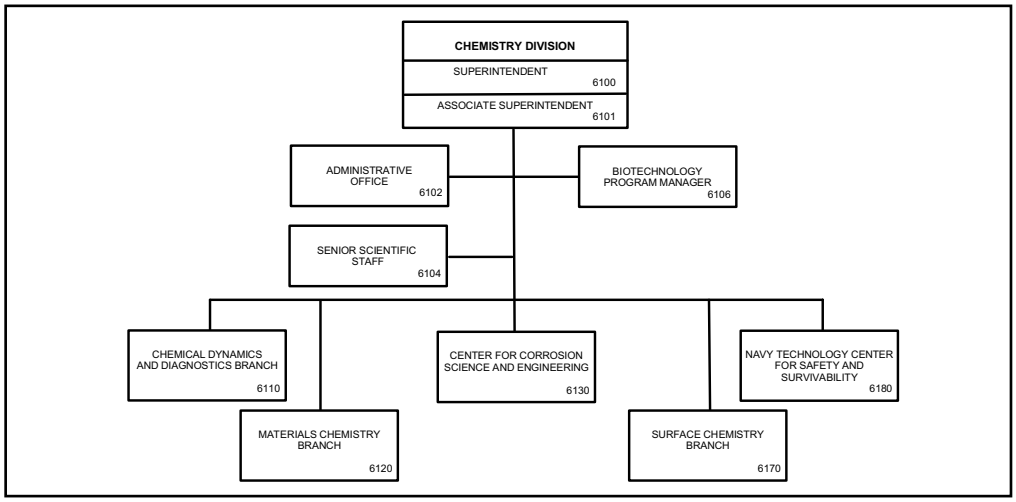
### Center for Corrosion Science and Engineering
- Materials failure analysis
- Marine coatings
- Cathodic protection
- Corrosion science
- Environmental fracture and fatigue
- Corrosion control engineering

### Surface/Interface Chemistry
- Tribology
- Surface properties of materials
- Surface/interface analysis
- Chemical/biological sensors
- Surface reaction dynamics
- Adhesion
- Bio/organic interfaces
- Diamond films
- Energy storage materials
- Nanostructured materials and interfaces
- Electrochemistry
- Plasmonics
- Synchrotron radiation applications

### Safety and Survivability
- Combustion dynamics
- Fire protection and suppression
- Personnel protection
- Modeling and scaling of combustion systems
- Mobility fuels
- Chemometrics/Data Fusion
- Trace Vapor Generation/TD/GC/MS/IR Detection Testbed

The Key West site of the NRL Center for Corrosion Science and Engineering specializes in understanding and modeling the marine environment's impact on Naval materials. A complete laboratory for the study of corrosion control technologies provides sponsors with prototypical seawater exposure of their systems.

The ex-USS *Shadwell* (LSD-15), moored in Mobile Bay, Alabama, is NRL's full-scale, advanced fire research vessel operated by the Chemistry Division.




## Basic Responsibilities

The Chemistry Division conducts basic research, applied research, and development studies in the broad fields of chemical/structural diagnostics, reaction rate control, materials chemistry, surface and interface chemistry, corrosion passivation, environmental chemistry, and ship safety/survivability. Specialized programs within these fields include coatings, functional polymers/elastomers, clusters, controlled release of energy, physical and chemical characterization of surfaces, electrochemistry, assembly and properties of nanometer structures, tribology, chemical vapor deposition/etching, atmosphere analysis and control, environmental protection/reclamation, prevention/control of fires, mobility fuels, modeling/simulation, and miniaturized sensors for chemical, biological, trace analysis and data fusion, and explosives.

To enhance protection of Navy personnel and platforms from damage and injury in peace and wartime, the Navy Technology Center for Safety and Survivability performs RDT&E on fire and personnel protection, fuels, chemical defense, submarine atmospheres, and damage control aspects of ship and aircraft survivability; supports Navy and Marine Corps requirements in these areas; and acts as a focus for technology transfer in safety and survivability.

To address problems in corrosion and marine fouling, a Marine Corrosion Facility is located in Key West, Florida. This laboratory resides in an unparalleled site for natural seawater exposure testing and marine related materials evaluation. The tropical climate is ideal for marine exposure testing. Along with the high quality seawater, the location provides small climatic variation and a stable biomass throughout the year.

**Personnel:** 103 full-time civilian; 3 full-time military; 3 intermittent/part-time

## Key Personnel

| Title | Code |
|---|---|
| Superintendent, Chemistry Division | 6100 |
| Associate Superintendent | 6101 |
| Administrative Officer | 6102 |
| Senior Scientific Staff | 6104 |
| Biotechnology Program Manager | 6106 |
| Head, Chemical Dynamics and Diagnostics Branch | 6110 |
| Head, Materials Chemistry Branch | 6120 |
| Head, Center for Corrosion Science and Engineering | 6130 |
| Head, Surface Chemistry Branch | 6170 |
| Head, Navy Technology Center for Safety and Survivability | 6180 |

**Point of contact:** Code 6102, (202) 767-2460

# Materials Science and Technology Division

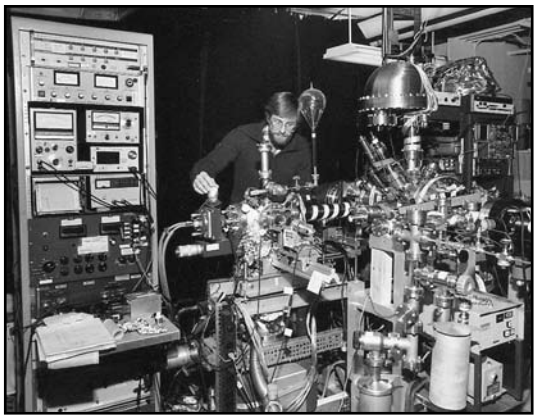
## Code 6300
## Research Activity Areas

### Materials and Sensors
- Superconducting materials
- Magnetic materials
- Nonlinear (chaotic) phenomena

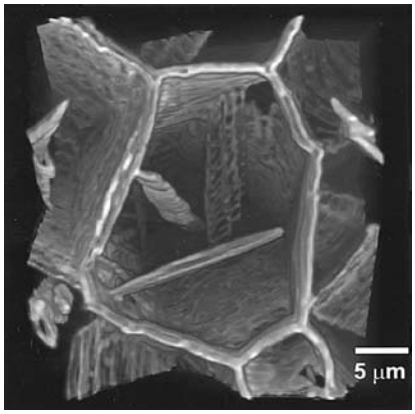
### Spintronics
- Laser direct write
- Glass fiber draw tower
- Polymer synthesis and characterization
- Precision calorimetry
- Thin film deposition
  - Pulsed laser deposition
  - Ion-beam-assisted deposition
  - Variable balance magnetron sputtering
- Ion engineering
  - Ion implantation
  - Reactive ion etching
- Functional materials
  - Optoelectronics
  - Electroceramics
  - Chemical sensors
- Analysis
  - Surface analysis by accelerator techniques
  - Trace element accelerator mass spectrometry

### Multifunctional Materials
- Composite multifunctional material systems
  - Structure-plus-power
  - Structure-plus-conduction
  - Structure-plus-acoustics
- Corrosion simulation and control
  - Modeling of electrochemical corrosion systems
  - Evaluation of cathodic protection system performance
- Computational modeling of active materials
- Mesoscale material characterization and simulation
  - Image-based modeling
  - Materials by design
- Biochemical surrogates and response simulation
- Synthesis and processing of advanced ceramics
  - High energy density dielectrics
  - Piezoelectrics
- Rapid prototyping
- Physical metallurgy
  - Ferrous and intermetallic alloys
  - Synthesis/processing of metal
  - Rapid solidiflation facility
  - Welding/joining technology
  - Micro/nanostructure characterization
  - Heat treating facilities
  - HIP/CIP

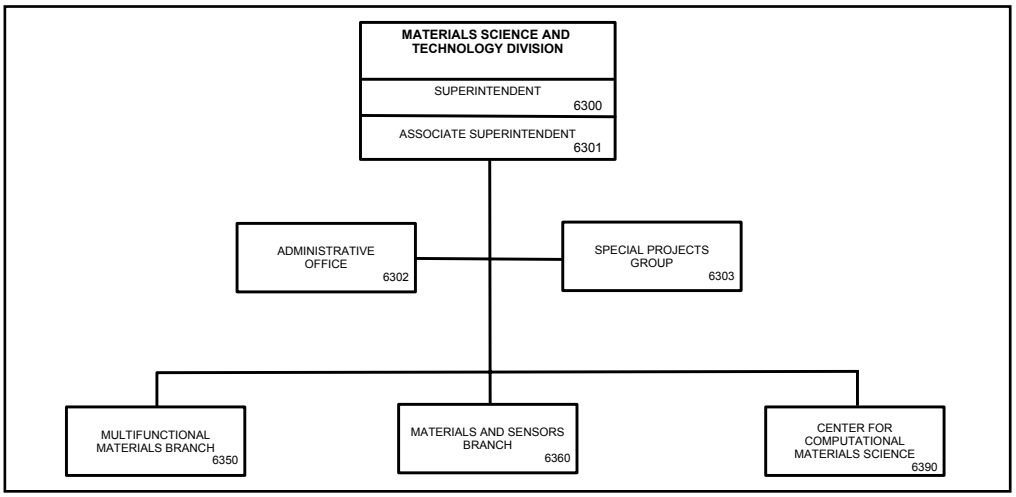
### Computational Materials Science
- Condensed matter theory
- Electronic structure of solids and clusters
- Molecular dynamics
- Quantum many-body theory
- Theory of magnetic materials
- Theory of alloys
- Semiconductor and surface physics
- Theoretical studies of phase transitions
- Atomic physics theory



Observing the growth of single crystal magnetic films on semiconductor substrates for electronic applications




3D reconstruction of cementite precipitates in an austenite grain




## Basic Responsibilities

The Materials Science and Technology Division conducts basic and applied research and engages in exploratory and advanced development of materials having substantive value to the Navy. R&D programs encompass the intrinsic behavior of metals, insulators, composites, and ceramics, including efforts in ferrous alloys, intermetallic compounds, superconducting, dielectric, and magnetic materials, films and coatings, and multifunctional materials systems. The programs encompass advanced synthesis and processing techniques as well as postprocessing techniques to fabricate sensors, devices, structures, and components. A variety of state-of-the-art characterization tools are used to probe the atomic and microstructure nature (composition and structure) of the materials as well as to delineate the fundamental properties of the material or material system. Response of materials and material systems to a variety of external influences (mechanical, chemical, optical, electromagnetic radiation, high-power lasers, temperature, etc.) is integral to the division's programs as well as performance and reliability projections for military service lifetime. The program includes strong theoretical, computational, and simulation efforts to predict, guide, and explain the behavior of materials and materials systems. Studies conducted in the division will provide guidance for the selection, design, certification, and life-cycle management of material in naval vehicles and systems. The diversity of R&D programs in the division is carried out by multidisciplinary teams of materials scientists, metallurgists, ceramists, physicists, chemists, and engineers using the most advanced testing facilities and diagnostic techniques.

**Personnel:** 110 full-time civilian

## Key Personnel

| Title | Code |
|---|---|
| Superintendent, Materials Science and Technology Division | 6300 |
| Senior Scientist | 6300.1 |
| Associate Superintendent | 6301 |
| Administrative Officer | 6302 |
| Head, Special Projects Group | 6303 |
| Head, Multifunctional Materials Branch | 6350 |
| Head, Materials and Sensors Branch | 6360 |
| Head, Center for Computational Materials Science | 6390 |

**Point of contact:** Code 6302, (202) 767-2458

# Laboratory for Computational Physics and Fluid Dynamics

## Code 6400
## Research Activity Areas

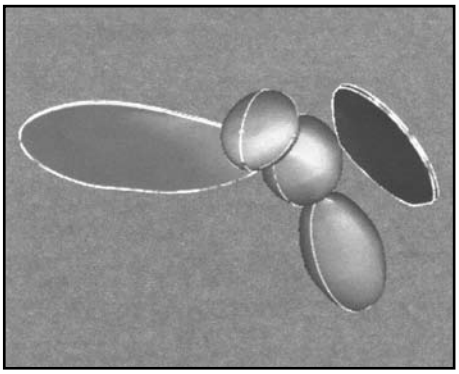
### Reactive Flows

Fluid dynamics in combustion
Turbulence in compressible flows
Multiphase flows
Turbulent jets and wakes
Turbulence modeling
Computational hydrodynamics
Propulsion systems analysis
Contaminant transport modelling
Fire and explosion mitigation

### Computational Physics Developments

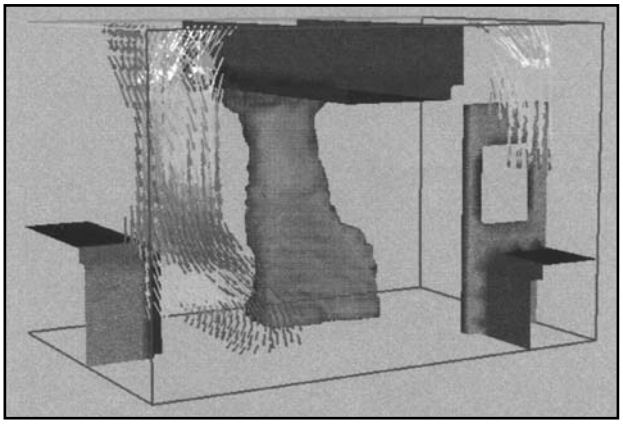
Laser plasma interactions
Inertial confinement fusion
Solar physics modeling
Dynamical gridding algorithms
Advanced graphical and parallel processing systems
Electromagnetic and acoustic scattering
Microfluidics
Fluid structure interaction
Shock and blast containment

Olive (32P) and Snuffy (24P) — Origins at work

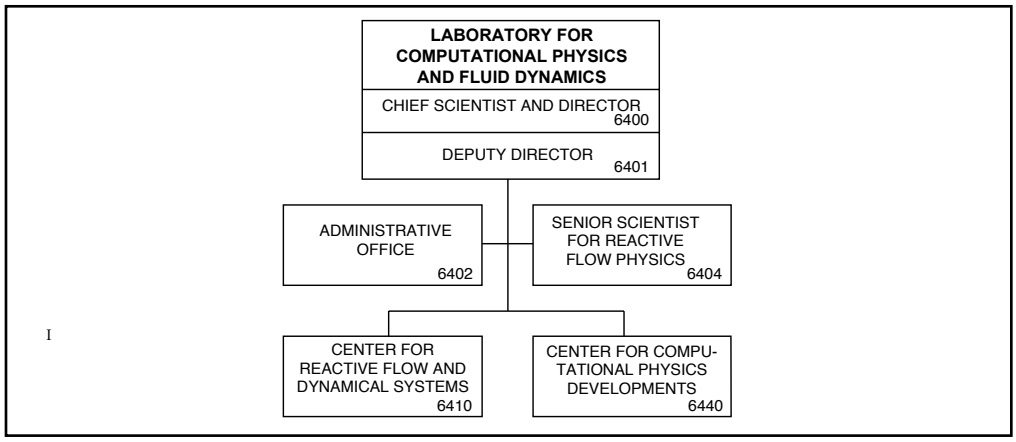


Unstructured grid technology has been used to obtain the surface pressure distribution on a hovering fruitfly *Drosophila*. Such computations are being carried out to gain insights into unsteady force production in nature that may guide in the design of insect-like autonomous air vehicles for the Navy.


This figure shows a contaminant cloud from a FAST3D-CT simulation of downtown Chicago using a $360 \times 360 \times 55$ grid (6 m resolution). A 3 m/s wind off the lake from the left blows contaminant across a portion of the detailed urban geometry. The contaminant is lofted rapidly above the tops of the majority of the buildings due to their geometrical effect.



Water-mist trajectories and temperature distributions during the suppression of a fire inside a complex ship compartment. Simulations and experiments have shown that using fine water-mist can significantly reduce the amount of water needed for fire suppression.




## Basic Responsibilities

The Laboratory for Computational Physics and Fluid Dynamics is responsible for the research leading to and the application of advanced analytical and numerical capabilities that are relevant to Navy, DoD, and other programs of national interest. This research is pursued in the fields of compressible and incompressible fluid dynamics, reactive flows, fluid/structure interaction including submarine and aerospace applications, atmospheric and solar geophysics, magnetoplasma dynamics for laboratory and space applications, application of parallel processing to large-scale problems such as unstructured grid generation for complex flows and target tracking and correlation for battle management, and in other disciplines of continuum and quantum computational physics as required to further the overall mission of the Naval Research Laboratory. The specific objectives of the Laboratory for Computational Physics and Fluid Dynamics are to develop and maintain state-of-the-art analytical and computational capabilities in fluid dynamics and related fields of physics; to establish in-house expertise in parallel processing for large-scale scientific computing; to perform analyses and computational experiments on specific relevant problems using these capabilities; and to transfer this technology to new and ongoing projects through cooperative programs with the research divisions at NRL and elsewhere.

**Personnel:** 22 full-time civilian

## Key Personnel

| Title | Code |
|---|---|
| Chief Scientist and Director | 6400 |
| Administrative Officer | 6402 |
| Senior Scientist for Reactive Flow Physics | 6404 |
| Head, Center for Reactive Flow and Dynamical Systems | 6410 |
| Head, Center for Computational Physics Developments | 6440 |

**Point of contact:** Code 6402, (202) 767-6581

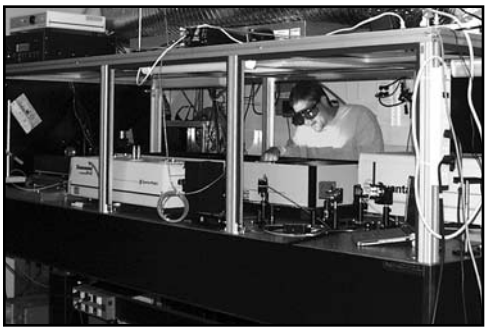
# Plasma Physics Division

## Code 6700
## Research Activity Areas

### Radiation Hydrodynamics
- Radiation hydrodynamics of Z-pinches and laser-produced plasmas
- X-ray source development
- Cluster dynamics in intense laser fields
- X-ray channeling and propagation
- Plasma kinetics for directed energy and fusion
- Plasma discharge physics
- Dense plasma atomic physics, equation of state
- Numerical simulation of high-density plasma
- Laser driven ion/neutron sources

### Laser Plasma
- Nuclear weapons stockpile stewardship
- Laser fusion, inertial confinement
- Megabar high-pressure physics
- Rep-rate KrF laser development
- Strongly coupled plasmas
- Laser fusion technology
- Laser fusion energy
- Detection of chemical/biological/nuclear materials

### Charged Particle Physics
- Applications of modulated electron beams
- Rocket, satellite, and shuttle-borne natural and active experiments
- Laboratory simulation of space plasma processes



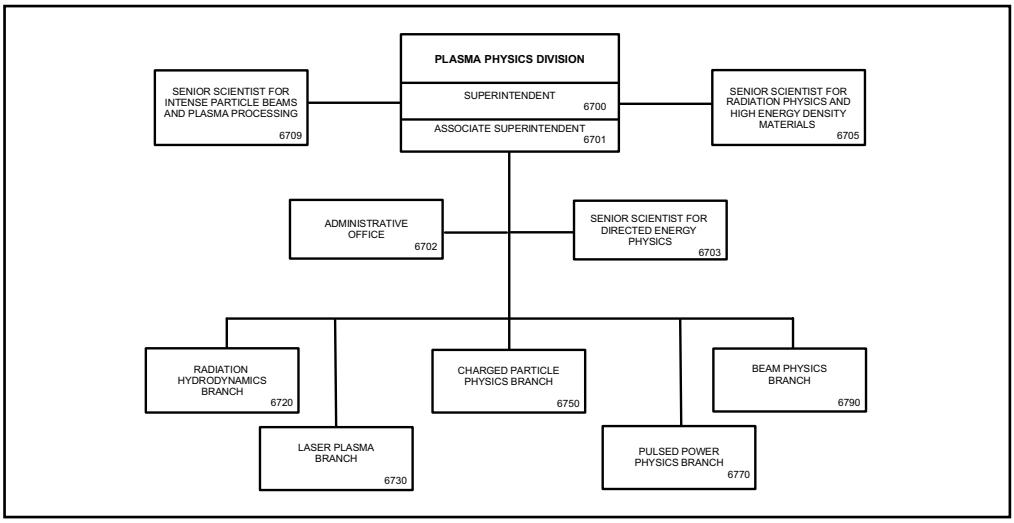
The NRL Ti:Sapphire Femtosecond Laser (TFL) currently operates at 50 fsec, 10 TW and provides a facility to conduct research in intense laser-plasma interactions, ultrashort intense laser propagation in the atmosphere, remote sensing of chem/bio agents, and laser induced electrical discharges.

- Large-area plasma processing sources
- Atmospheric and ionospheric GPS sensing
- Ionospheric effects on communications
- Electromagnetic launchers
- Radiation belt remediation

### Pulsed Power Physics
- Production, focusing, and propagation of intense electron and ion beams
- High-power, pulsed radiography
- Plasma radiator and bremsstrahlung diode sources
- Capacitive and inductive energy storage
- Nuclear weapons effects simulation
- Electromagnetic launchers
- Detection of Special Nuclear Materials
- Advanced energetics via stimulated nuclear decay

### Beam Physics
- Advanced accelerators and radiation sources
- Microwave, plasma, and laser processing of materials
- Microwave sources: Magnicons and gyrotrons
- Nonlinear dynamics of coupled lasers
- Ultrahigh-intensity laser-matter interactions
- Free electron lasers and laser synchrotrons
- Theory and simulation of space and solar plasmas
- Global ionospheric and space weather modeling
- Laser propagation in the atmosphere
- Underwater laser interactions

The Nike is the world's largest krypton fluoride (KrF) laser. Its operation is funded by the U.S. Department of Energy to explore physics issues for laser fusion. Shown is the propagation bay where 56 short-duration (4–5 ns) beams are directed by mirrors first to the electron-beam-pumped amplifiers and then to the target facility. The Nike KrF system achieves extremely uniform high-intensity illumination of planar targets by overlapping numerous smoothed laser beams. Typical experiments include studies of the ablative acceleration of matter to high velocities (100 km/sec) and studies of the reaction of materials to very high pressures (10 million atmospheres) produced by the laser light.




## Basic Responsibilities

The Plasma Physics Division conducts a broad theoretical and experimental program of basic and applied research in plasma physics, laboratory discharge, and space plasmas, intense electron and ion beams and photon sources, atomic physics, pulsed power sources, laser physics, advanced spectral diagnostics, and nonlinear systems. The effort of the Division is concentrated on a few closely coordinated theoretical and experimental programs. Considerable emphasis is placed on large-scale numerical simulations related to plasma dynamics; ionospheric, magnetospheric, and atmospheric dynamics; nuclear weapons effects; inertial confinement fusion; atomic physics; plasma processing; nonlinear dynamics and chaos; free electron lasers and other advanced radiation sources; advanced accelerator concepts; and atmospheric laser propagation. Areas of experimental interest include laser-plasma, laser-electron beam, and laser-matter interactions, high-energy laser weapons, laser shock hydrodynamics, thermonuclear fusion, electromagnetic wave generation, the generation of intense electron and ion beams, large-area plasma processing sources, electromagnetic launchers, high-frequency microwave processing of ceramic and metallic materials, advanced accelerator development, inductive energy storage, laboratory simulation of space plasma phenomena, high altitude chemical releases, and in situ and remote sensing space plasma measurements.

**Personnel:** 97 full-time civilian

### Key Personnel

| Title | Code |
|---|---|
| Superintendent, Plasma Physics Division | 6700 |
| Associate Superintendent | 6701 |
| Administrative Officer | 6702 |
| Senior Scientist, Directed Energy Physics | 6703 |
| Senior Scientist, Radiation Physics and High Energy Density Materials | 6705 |
| Senior Scientist, Intense Particle Beams and Plasma Processing | 6709 |
| Head, Radiation Hydrodynamics Branch | 6720 |
| Head, Laser Plasma Branch | 6730 |
| Head, Charged Particle Physics Branch | 6750 |
| Head, Pulsed Power Physics Branch | 6770 |
| Head, Beam Physics Branch | 6790 |

**Point of contact:** Code 6701, (202) 767-2997

# Electronics Science and Technology Division

## Code 6800
## Research Activity Areas

### Electronic Materials
- Preparation and development of magnetic, dielectric, optical, and semiconductor materials including micro- and nanostructures
- Electrical, optical, and magneto-optical studies of semiconductor microstructures and nanostructures, superlattices, surfaces, and interfaces
- Impurity and defect studies
- Surface research and interface physics
- Theoretical solid state physics

### Microwave Technology
- Microwave and millimeter-wave integrated circuits and components research
- High-frequency device design, simulation, and fabrication
- Reliability and failure physics of electronic devices and circuits
- High-temperature superconductors

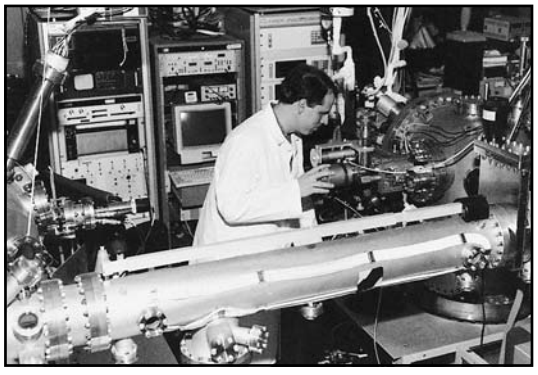
### Power Electronics
- Power device design, simulation, and fabrication
- High-voltage/high-temperature power device and components research
- Growth and characterization of wide bandgap and thin film materials for power devices
- Wafer bonding for power devices and novel substrates
- Reliability and failure physics of power devices

### Nanoelectronics
- Characterization of nanosurfaces and interfaces
- Nanoelectronic device research and fabrication
- Processing research for nanometric devices

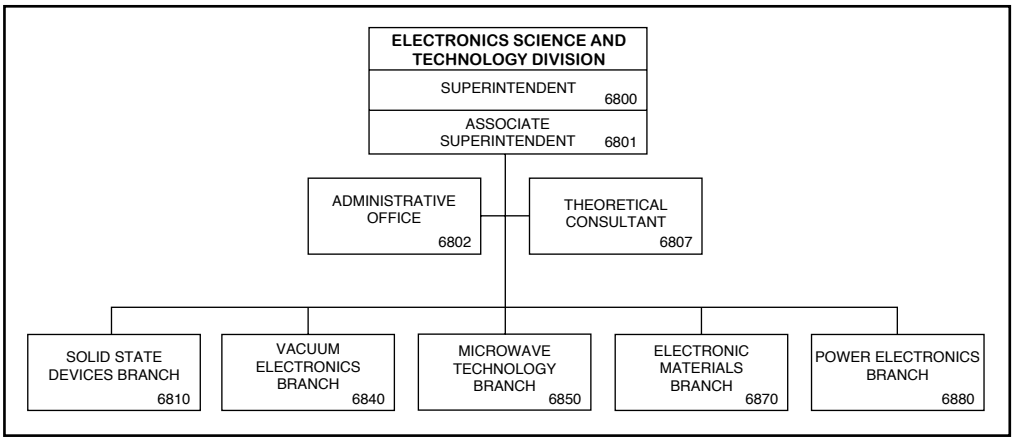
### Radiation Effects
- Space experiments and satellite survivability
- Single event and total ionizing dose effects
- Radiation hardening of electronics devices, circuits, and optoelectronic sensors
- Ultrafast charge collection
- Environmental hazard remediation
- Advanced photovoltaic technologies
- Femtosecond laser research
- Radiation effects in microelectronics and photonics

### Solid State Devices
- Solid state optical sensors
- Photovoltaic research and development
- Mid and far infrared photodiodes/arrays
- Microelectronics device research and fabrication
- Solid state circuits research
- Signal processing research

### Vacuum Electronics
- Compact millimeter-wave power amplifier research and development
- Cathode research and electron emission science
- Materials development for RF electronics applications
- Development of micro-fabrication techniques for upper mm-wave devices
- Theory and numerical techniques for modeling of fast-wave and slow-wave devices
- Techniques for high data rate digital communications



The EPICENTER specializes in molecular beam epitaxial growth of nanostructures created by alternating layers of narrow bandgap materials made available from four ultrahigh-vacuum chambers. These structures are expected to improve the performance of far-infrared detectors, midwave lasers, and superhigh frequency transistors and resonant tunneling diodes. Here a scientist creates a structure using high-vacuum, chamber-to-chamber sample transfer.




## Basic Responsibilities

The Electronics Science and Technology Division conducts programs of basic science and applied research and development in materials growth and properties, surface physics, micro- and nanostructure electronics, microwave techniques, microelectronic device research and fabrication, vacuum electronics, and cryoelectronics, including superconductors. The activities of the Division integrate device research with basic materials investigations and with systems research and development needs.

**Personnel:** 98 full-time civilian

## Key Personnel

| Title | Code |
|---|---|
| Superintendent, Electronics Science and Technology Division | 6800 |
| Associate Superintendent | 6801 |
| Administrative Officer | 6802 |
| Theoretical Consultant | 6807 |
| Head, Solid State Devices Branch | 6810 |
| Head, Vacuum Electronics Branch | 6840 |
| Head, Microwave Technology Branch | 6850 |
| Head, Electronic Materials Branch | 6870 |
| Senior Scientist for Nanoelectronics | 6877 |
| Head, Power Electronics Branch | 6880 |

**Point of contact:** Code 6802, (202) 767-3416

# Center for Bio/Molecular Science and Engineering

## Code 6900
## Research Activity Areas

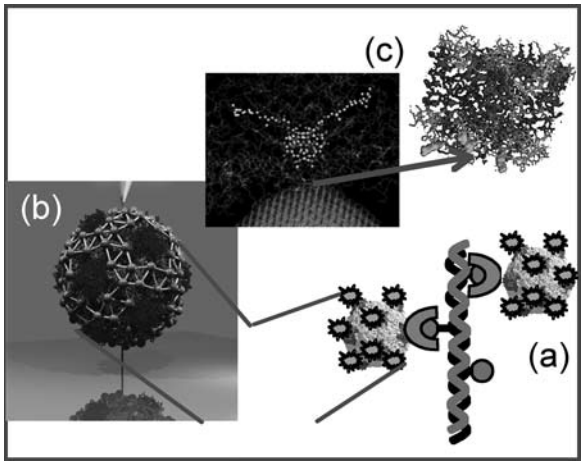
### Biologically Derived Microstructures
Self-assembly, molecular machining
Synthetic membranes
Nanocomposites
Tailored electronic materials
Low observables
Molecular engineering, biomimetic materials
Molecular imprinting
Viral scaffolds
Multifunctional decontamination coatings

### Biosensors
Binding polypeptides and proteins
Cell-based biosensor
DNA biosensor
Fiber-optic biosensor
Flow immunosensor
Array-based sensors
Optical biosensor
Microfluidics

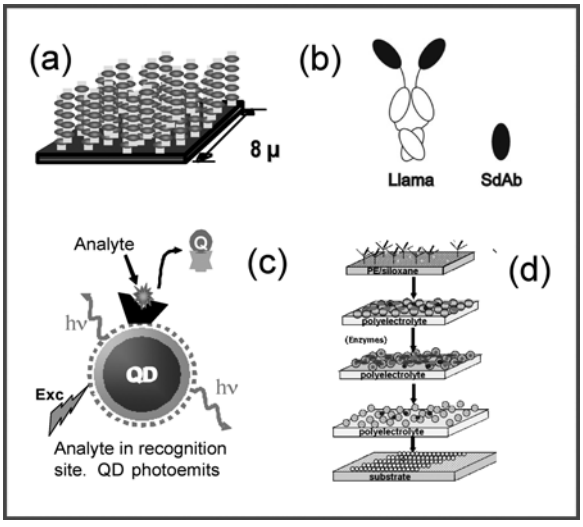
### Novel Materials
Soil/groundwater explosives detection
Antifouling paint, controlled release
Single chain antibodies
Liquid crystal nanoparticles
Liquid crystal elastomers
Nano and menoporous materials
Quantum dot and protein conjugates
Biomimetric materials

### Molecular Biology
Genomics and proteomics of marine bacteria
Tissue engineering
Gene arrays, biomarkers
System and synthetic biology

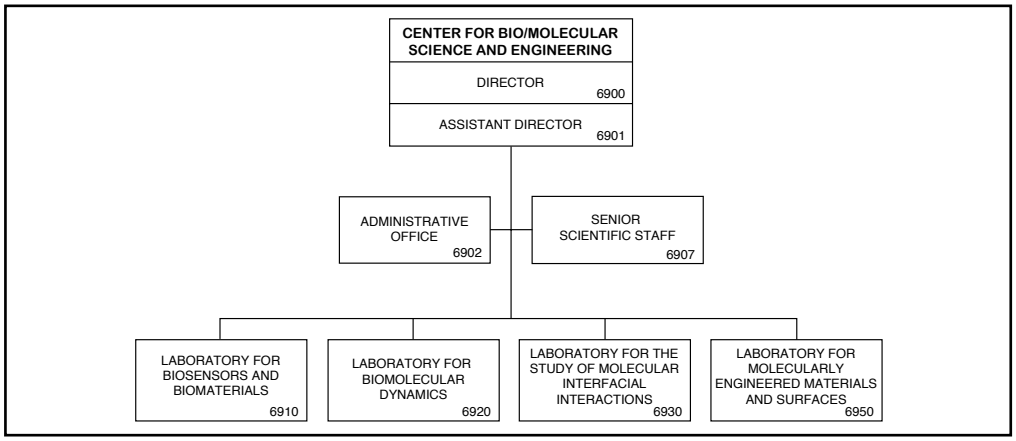
### Energy Harvesting
Biomaterials for charge storage
Ocean floor biofuel cell
Photo induced electron transfer




Proteins and viruses as scaffolds for (a) chem/bio nanosensors and (b) nanoscale electronics and (c) photovoltaic devices.




Novel approaches to chem/bio detection and decontamination: (a) sequence based pathogen detection, (b) heat stable single domain antibody, (c) Quantum dot FRET based analyte recognition and (d) multilayer assembly assenbly based decontamination coating.




## Basic Responsibilities

The Center for Bio/Molecular Science and Engineering is using the tools of modern biology, physics, chemistry, and engineering to develop advanced materials and sensors. The long-term research goal is first to gain a fundamental understanding of the relationship between molecular architecture and the function of materials, then apply this knowledge to solve problems for the Navy and DoD community. The key theme is the study of complex bio/molecular systems with the aim of understanding how "nature" has approached the solution of difficult structural and sensing problems. Technological areas currently being studied include molecular and microstructure design, molecular biology, self-assembly, controlled release and encapsulation, and surface patterning and modification. Much of the research deals with the self-assembly of lipids, proteins, and liquid crystals into complex microstructures for use in advanced material applications, and the harnessing of the recognition functions of proteins and cells for the development of advanced sensors. A highly multidisciplinary staff is required to pursue these research and development programs. The Center provides a stimulating environment for cross-disciplinary programs in the areas of immunology, biochemistry, electrochemistry, inorganic and polymer chemistry, microbiology, microlithography, photochemistry, biophysics, spectroscopy, advanced diagnostics, organic synthesis, and electro-optical engineering.

**Personnel:** 49 full-time civilian

## Key Personnel

| Title | Code |
|---|---|
| Director, Center for Bio/Molecular Science and Engineering | 6900 |
| Assistant Director | 6901 |
| Administrative Officer | 6902 |
| Head, Senior Scientific Staff | 6907 |
| Head, Laboratory for Biosensors and Biomaterials | 6910 |
| Head, Laboratory for Biomolecular Dynamics | 6920 |
| Head, Laboratory for the Study of Molecular Interfacial Interactions | 6930 |
| Head, Laboratory for Molecularly Engineered Materials and Surfaces | 6950 |

**Point of contact:** Code 6901, (202) 404-6042

# Ocean and Atmospheric Science and Technology Directorate

# OCEAN AND ATMOSPHERIC SCIENCE AND TECHNOLOGY DIRECTORATE

## Code 7000

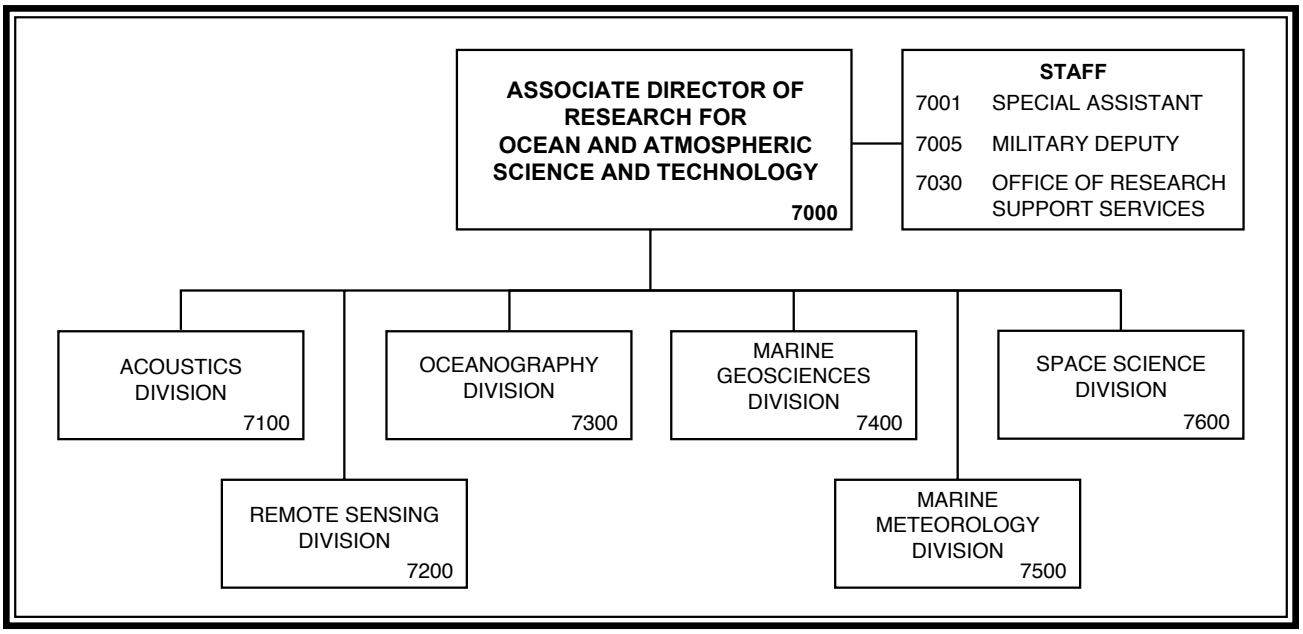
The Ocean and Atmospheric Science and Technology Directorate performs research and development in the fields of acoustics, remote sensing, oceanography, marine geosciences, marine meteorology, and space science. Areas of emphasis in acoustics include advanced acoustic concepts and computation, acoustic signal processing, physical acoustics, acoustic systems, ocean acoustics, and acoustic simulation and tactics. Areas of emphasis in remote sensing include radio, infrared, and optical sensors, remote sensing physics and hydrodynamics, remote sensing simulation, and imaging systems. Areas of emphasis in oceanography include coastal and open ocean dynamics, ocean modeling and prediction, coastal and open ocean processes, remote sensing applications to oceanography, and marine biocorrosion processes. Areas of emphasis in marine geosciences include marine physics, seafloor sciences, geospatial information science and technology, and mapping, charting, and geodesy. Areas of emphasis in marine meteorology include atmospheric dynamics for theater-wide, tactical scale prediction systems and forecast support, and meterological applications development. Areas of emphasis in space science include middle and upper atmosphere physics, solar terrestrial relationships, solar physics, and higher energy astronomy. Senior naval officers are assigned as military advisors to help maintain the directorate focus on operational Navy and other DoD requirements in these areas of emphasis. The directorate is responsible for administrative and technical support to major activities in Washington, DC; Stennis Space Center, Mississippi; and Monterey, California.

# Associate Director of Research for Ocean and Atmospheric Science and Technology

**Dr. E.R. Franchi** was born in Huntington, New York. He graduated from Clarkson University in 1968, with a Bachelor of Science degree in mathematics. He received his Master of Science (1970) and Ph.D. (1973) degrees both in applied mathematics from Rensselaer Polytechnic Institute. After completing his graduate studies, Dr. Franchi accepted a research position with Bolt, Beranek, and Newman where he performed validation studies of underwater acoustic propagation and noise models.

Dr. Franchi joined the Naval Research Laboratory in 1975 as a research mathematician in the Acoustics Division. In this position, he conducted and directed research in low frequency acoustic reverberation and scattering, including design and conduct of field experiments, development of signal processing techniques, data analysis and interpretation, computer prediction models, and active sonar performance studies. In 1986, he was named Head of the Acoustic Systems Branch where he was responsible for programs that emphasized theoretical, experimental, and computational research to understand the physical mechanisms of acoustic propagation, scattering, and ambient noise that control the design and performance of large- aperture passive sonar systems, low frequency active sonar systems, and shallow water sonar systems. In July 1988, Dr. Franchi was appointed to the Senior Executive Service and selected as the Associate Technical Director of the Naval Ocean Research and Development Activity (NORDA) and its Director of Ocean Acoustics and Technology. The Directorate conducted basic, exploratory, and advanced research and development and program management in the areas of acoustic model development and simulation, ocean acoustics measurements, and ocean engineering in support of all undersea warfare missions. In October 1992, the Directorate became the Center for Environmental Acoustics in the Acoustics Division of the Naval Research Laboratory, with Dr. Franchi as Director. Dr. Franchi was selected to the position of Superintendent of the Acoustics Division in October 1993. The Division conducts basic, exploratory, and applied research and development in areas of acoustic modeling and simulation, ocean acoustics measurements, acoustic systems development, acoustic signal processing, and physical acoustics. He was responsible for the technical/scientific management, direction, and administration of programs with a total budget in excess of $25M, and for efficient management of division resources including the activities of approximately 110 civilian personnel. He served as Acting Associate Director of Research for the Ocean and Atmospheric Science and Technology Directorate from October 2001 to May 2002 and from June 2007 to April 2008. In April 2008, he was selected as the Associate Director.

Dr. Franchi received the Presidential Rank Award of Meritorious Executive in 2003. He has over 35 years experience in underwater acoustics research and is the author/co-author of over 35 publications. He is recognized as an authority on underwater acoustic scattering and reverberation and has played major roles in Navy low frequency active sonar programs as both performer and advisor/consultant. He served as the U.S. National Leader of the Technical Cooperation Program's multinational Panel on ASW Systems and Technology from 1996 to 2002, and has served as its Panel Chairman from 2003 to the present. He represents the United States to the NATO Undersea Research Centre Scientific Committee of National Representatives. He was elected to Pi Mu Epsilon, the Honorary National Mathematics Society, while an undergraduate at Clarkson University. Dr. Franchi is a member of the Acoustical Society of America and past member of the Mathematical Association of America.




## Key Personnel

| Name | Title | Code |
|---|---|---|
| Dr. E.R. Franchi | Associate Director of Research for Ocean and Atmospheric Science and Technology | 7000 |
| Mrs. L.A. Liston | Special Assistant | 7001 |
| CDR E.J. Buch, USN | Military Deputy | 7005 |
| Dr. E.R. Franchi | Head, Ship Support Group | 7008 |
| Dr. H.C. Eppert, Jr. | Head, Office of Research Support Services | 7030 |
| Dr. D.G. Todoroff | Superintendent, Acoustics Division | 7100 |
| Vacant | Naval Science (Acoustic) Research Coordinator | 7105 |
| Dr. R.M. Bevilacqua | Superintendent, Remote Sensing Division | 7200 |
| Vacant | Military Deputy | 7205 |
| Dr. R.H. Preller | Superintendent, Oceanography Division | 7300 |
| CDR T. Lane, USN | Military Deputy | 7305 |
| Dr. H.C. Eppert, Jr. | Superintendent, Marine Geosciences Division | 7400 |
| CDR M. Spearman, USN | Military Deputy | 7405 |
| Dr. S.W. Chang | Superintendent, Marine Meteorology Division | 7500 |
| CDR K.A. Wos, USN | Military Deputy | 7505 |
| Dr. J.P. Dahlburg | Superintendent, Space Science Division | 7600 |
| LCDR R. Murphy, USN | Space Test Program Officer | 7603 |

**Point of contact:** Code 7000A, (202) 404-8174

# Office of Research Support Services (NRL-SSC)

## Code 7030
## Staff Activity Areas

### Office of Research Support
Conference coordination, video teleconferencing
Directives, reports, forms

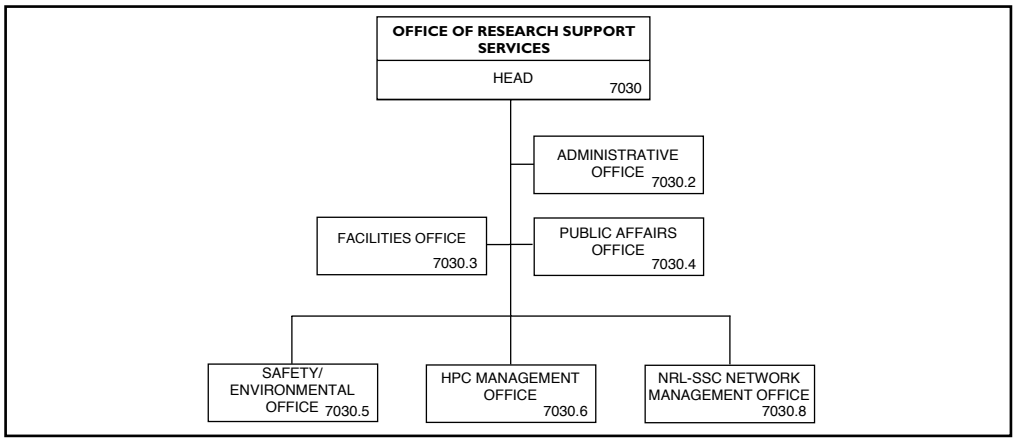
### Facilities Office
Facilities planning and maintenance
Vehicles

### HPC Management Office
Supercomputing interface management

### Safety/Environmental Office
Industrial/laboratory safety
Specialized safety training
Hazard abatement
Mishap prevention
Hazardous materials program
Hazardous waste disposal

### Public Affairs Office
Community relations
News releases
Exhibits
Information
Freedom of Information Act

### NRL-SSC Network Management Office
Data communications
Data networking
Computer network maintenance




## Basic Responsibilities

The Office of Research Support Services is responsible for the operational and management support necessary for the day-to-day operations at NRL Stennis Space Center, Mississippi (NRL-SSC). The Head of NRL-SSC acts for the Commanding Officer in dealing with local Naval, Federal, and civil activities and personnel on matters relating to NRL-SSC support activities and facilities, community and multicommand issues, and safety and disaster control measures.

Support functions include public affairs, network support, safety, high performance computer management, and support services to include management, administration, and facilities.

**Personnel:** 8 full-time civilian

### Key Personnel

| Title | Code |
|---|---|
| Head, Office of Research Support Services | 7030 |
| Administrative Officer | 7030.2 |
| Head, Facilities Office | 7030.3 |
| Public Affairs Office | 7030.4 |
| Safety/Environmental Officer | 7030.5 |
| HPC Management Office | 7030.6 |
| NRL-SSC Network Management Office | 7030.8 |

**Point of contact:** Code 7030, (228) 688-4010; DSN 828-4010

# Acoustics Division

## Code 7100
## Staff Activity Areas

Special programs management

System concepts and studies

## Research Activity Areas

### Acoustic Signal Processing

- Random media propagation
- Limits of acoustic array performance
- Underwater acoustic communications and networking
- Undersea noise signal characterization and modeling
- Surf zone noise generation
- Shallow water acoustic surveillance methods
- Geophysical inversion
- Matched field processing and inversion
- High-frequency acoustic flow visualization
- Uncertainty-based modeling

### Physical Acoustics

- Structural acoustics
- Active sound control
- Fiber-optic acoustic sensors
- Acoustics of coatings
- Dynamics of complex structures
- Target strength/radiation modeling
- Acoustic transduction
- Inverse scattering
- Nanomicrostructure dynamics

The acoustic source-receiver array (ASRA) contains twelve sources/receivers. The purpose is to conduct multiple-input multiple-output (MIMO) underwater acoustic communications experiments.

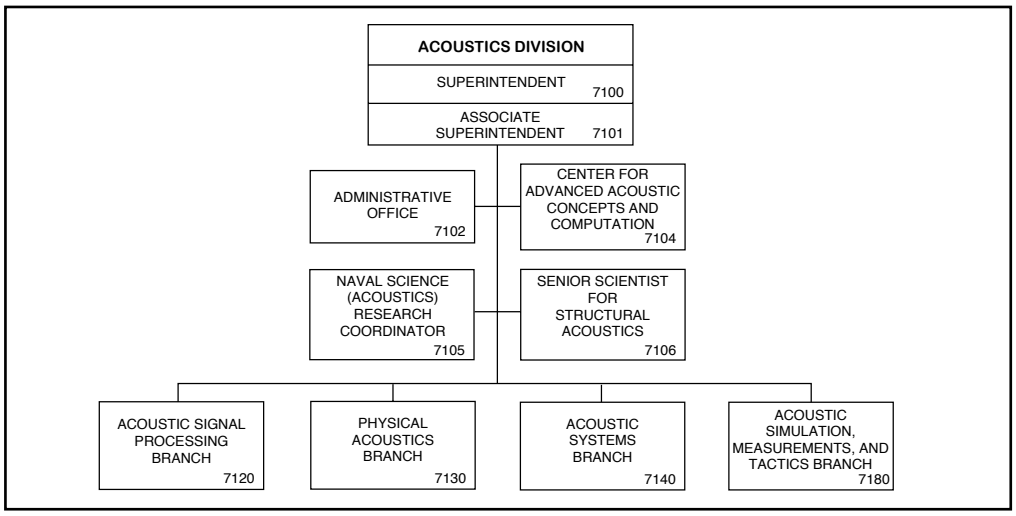
### Acoustic Systems

- Ocean boundary scattering
- Shallow water active classification
- Statistical characterization of reverberation
- Active sonar performance modeling
- Matched field processing
- Acoustic inversion techniques
- Acoustic propagation
- Nonlinear signal propagation
- Acoustics of bubbly media, metamaterials

### Acoustic Simulation, Measurements, and Tactics

- Coupled dynamic ocean and acoustic modeling
- Ocean acoustic propagation and scattering models
- Ocean ambient noise models and simulation
- Supercomputer and scalable acoustic models
- Fleet application acoustic models
- Environmental acoustic assessments and characterizations
- High-frequency seafloor and ocean acoustic measurements
- Biologic ocean volume reverberation measurements
- Multisensor system optimization
- Tactical oceanography simulations and databases
- Warfare effectiveness studies and optimizations

Structural acoustic studies in the one-million-gallon Acoustic Holographic Pool Facility




## Basic Responsibilities

The Acoustics Division conducts basic and applied research in undersea physics. The basic research areas are signal processing, ocean acoustics and the associated description of the ocean environment as it impacts advanced systems, and physical acoustics. The applied spectrum includes developing and proving system concepts; signal processing for active and passive detection, tracking, and classification of underwater targets; echo strength; structural acoustics; large area assessment techniques; and development of processing systems and techniques. Also included are basic and applied research in simulations and tactics as influenced by the environment. The Division program is interactive with the ONR Contract Research Program and other research laboratories, both U.S. and foreign.

**Personnel:** 76 full-time civilian

## Key Personnel

| Title | Code |
|---|---|
| Superintendent, Acoustics Division | 7100 |
| Associate Superintendent | 7101 |
| Administrative Officer | 7102 |
| Head, Center for Advanced Acoustic Concepts and Computation | 7104 |
| Naval Science (Acoustics) Research Coordinator | 7105 |
| Senior Scientist for Structural Acoustics | 7106 |
| Head, Acoustic Signal Processing Branch | 7120 |
| Head, Physical Acoustics Branch | 7130 |
| Head, Acoustic Systems Branch | 7140 |
| Head, Acoustic Simulation, Measurements, and Tactics Branch | 7180 |

**Point of contact:** Code 7100, (202) 767-3482

# Remote Sensing Division

## Code 7200
## Research Activity Areas

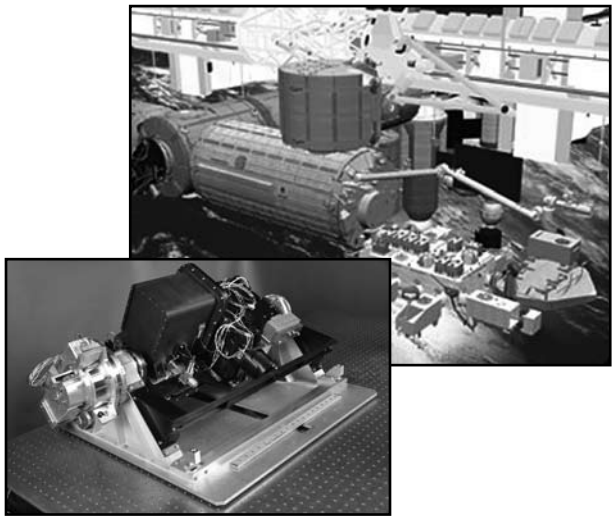
### Remote Sensing
- Sensors
  - SAR
  - Imaging radar
  - Passive microwave imagers
  - CCDs and focal plane arrays
  - Thermal IR cameras
  - Fabry-Perot spectrometers
  - Imaging spectrometers
  - Radio interferometers
  - Optical interferometers
  - Adaptive optics
  - Lidar
  - Spaceborne and airborne systems
- Research Areas
  - Radiative transfer modeling
  - Coastal oceans
  - Marine ocean boundary layer
  - Polar ice
  - Middle atmosphere
  - Global ocean phenomenology
  - Environmental change
  - Ocean surface wind vector
  - Soil moisture
  - Ionosphere
  - Data assimilation

### Astrophysics
- Optical interferometry
- Radio interferometry
- Fundamental astrometry and reference frames
- Fundamental astrophysics
- Star formation
- Stellar atmospheres and envelopes
- Interstellar medium, interstellar scattering pulsars
- Low-frequency astronomy

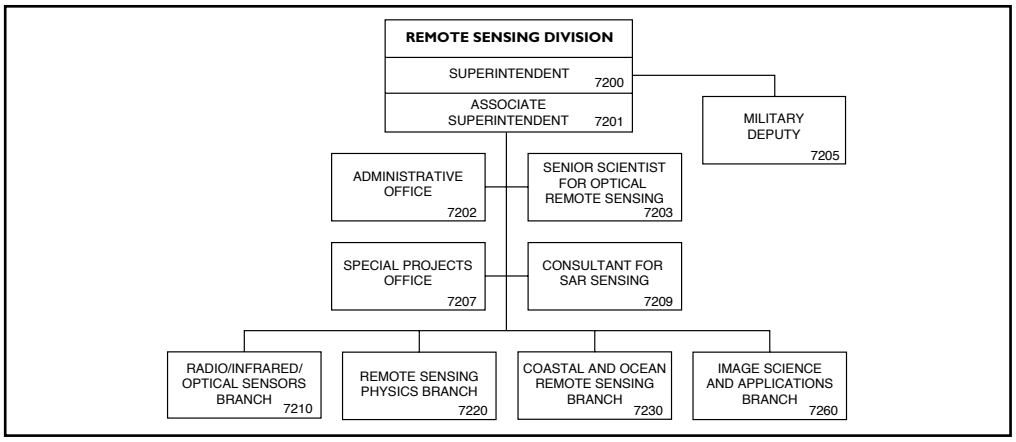
The WindSat polarimetric radiometer prior to spacecraft integration.

### Physics of Atmospheric/Ocean Interaction
- Mesoscale, fine-structure, and microstructure
- Aerosol and cloud physics
- Mixed layer and thermocline applications
- Sea-truth towed instrumentation techniques
- Turbulent jets and wakes
- Nonlinear and breaking ocean waves
- Stratified and rotating flows
- Turbulence modeling
- Boundary layer hydrodynamics
- Marine hydrodynamics
- Computational hydrodynamics

### Imaging Research/Systems
- Remotely sensed signatures analysis/simulation
- Real-time signal and image processing algorithm/systems
- Image data compression methodology
- Image fusion
- Automatic target recognition
- Scene/sensor noise characterization
- Image enhancement/noise reduction
- Scene classification techniques
- Radar and laser imaging systems studies
- Coherent/incoherent imaging sensor exploitation
- Numerical modeling simulation
- Environmental imagery analysis



The Hyperspectral Imager for the Coastal Ocean, or HICO, shown in the laboratory is optimized to image the coastal ocean and adjacent land in 128 contiguous color bands. This spectral data will be used to develop maps of water depth, water optical properties, and land vegetation and soil bearing strength. HICO was deployed to the International Space Station in September 2009, providing scientific imagery of varied coastal types worldwide.




## Basic Responsibilities

The Remote Sensing Division conducts a program of basic research, science, and applications aimed at the development of new concepts for sensors and imaging systems for objects and targets on the Earth, in the near-Earth environment, and in deep space. The research, both theoretical and experimental, deals with discovering and understanding the basic physical principles and mechanisms that give rise to target and background emission and to absorption and emission by the intervening medium. The accomplishment of this research requires the development of sensor systems technology. The development effort includes active and passive sensor systems to be used for the study and analysis of the physical characteristics of phenomena that give rise to naturally occurring background radiation, such as that caused by the Earth's atmosphere and oceans, as well as man-made or induced phenomena, such as ship/submarine hydrodynamic effects. The research includes theory, laboratory, and field experiments leading to ground-based, airborne, or space systems for use in such areas as remote sensing, astrometry, astrophysics, surveillance, nonacoustic ASW, and improved meteorological support systems for the operational Navy. Special emphasis is given to developing space-based platforms and exploiting existing space systems.

**Personnel:** 97 full-time civilian

### Key Personnel

| Title | Code |
|---|---|
| Superintendent, Remote Sensing Division | 7200 |
| Associate Superintendent | 7201 |
| Administrative Officer | 7202 |
| Military Deputy | 7205 |
| Head, Radio/Infrared/Optical Sensors Branch | 7210 |
| Head, Remote Sensing Physics Branch | 7220 |
| Head, Coastal and Ocean Remote Sensing Branch | 7230 |
| Head, Image Science and Applications Branch | 7260 |

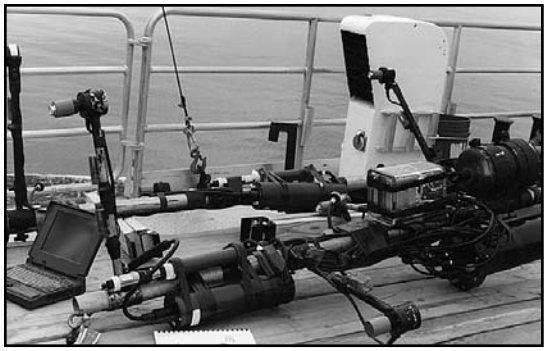
**Point of contact:** Code 7200, (202) 767-3391

# Oceanography Division

## Code 7300
## Research Activity Areas

### Ocean Dynamics and Prediction

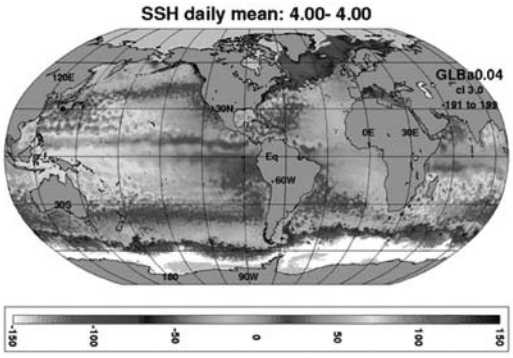
- Circulation
  - Global resolution of circulation and meso-scale fields
  - Littoral circulation at the coast, bays, and estuaries
  - Satellite observation processing and assimilation
  - UUV adaptive sampling
  - Observation system simulation experiments
  - Ice volume and ice drift
  - Tidal currents and heights
- Surface effects
  - Surface wave effects globally and into bays
  - Wave breaking
  - Mixed layer dynamics
  - Swell propagation and dynamics
  - Phase averaged wave evolution
  - Phase resolved wave dynamics
- Nearshore
  - Wave breaking at the shore
  - Rip currents at the shore
  - Tidal currents and heights into rivers
  - Nonlinear wave interaction
  - Sensor deployment optimization
- Acoustic effects
  - Sound speed variation for acoustic propagation
  - Internal waves, solitons, and bores for beam focusing
  - Wave bubble entrainment and noise generation



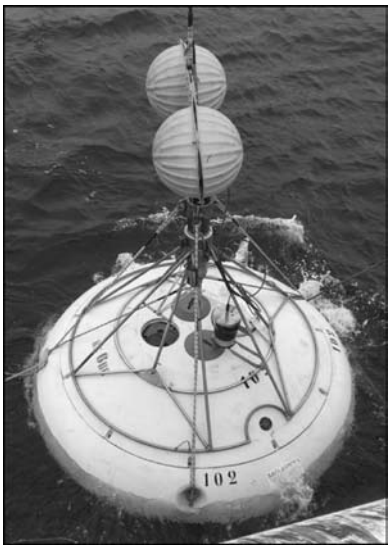
Optical mooring equipment for shallow water showing attenuation and absorption meters and irradiance sensors

### Ocean Sciences

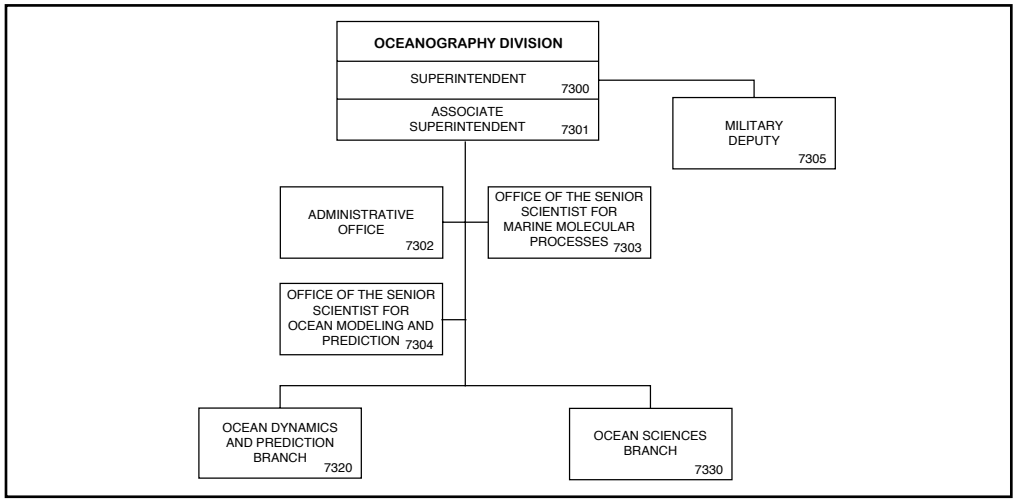
- Dynamical processes
  - Coastal current systems
  - Waves and bubbles
- Coupled systems
  - Air/ocean/acoustic coupling
  - Coupled bio/optical/physical processes
  - Coupled physical/sediment processes
- Remote sensing applications
  - Color/hyperspectral signatures
  - Ocean optics
  - Sea surface salinity
- Microbiologically influenced corrosion
  - Metal microbe interaction




Global Sea Surface Height from the 1/25° Hybrid Coordinate Ocean Model (HYCOM) including ice cover.



The SEPTR (Shallow water Environmental Profiler in Trawl-safe Real-time configuration) consists of an acoustic Doppler current profiler (ADCP), a Wave-Tide Gauge, two acoustic releases, and a buoy, controlled by a winch within the trawl-resistant bottom mount, that houses conductivity, temperature, and depth (CTD) sensors which are profiled between the bottom unit and ocean surface multiple times per day.




## Basic Responsibilities

The Oceanography Division conducts basic and applied research in description and modeling of biological, physical, and dynamical processes in open ocean, regional, and littoral areas; in exploitation of satellite, airborne, and in situ sensors for environmental characterization; and in investigation and application of microbial processes to Navy problems. The oceanographic research is both theoretical and experimental in nature and is focused on understanding and modeling ocean, coastal, and littoral area hydro/thermodynamics, circulation, waves, ice dynamics, air-sea exchange, optics, and small and microscale processes. Analytical methods and algorithms are developed to provide quantitative retrieval of geophysical parameters of Navy interest from state-of-the-art sensor systems. The Division work includes analysis of biological processes that mediate and control optical properties of the oceans, coastal, and littoral regions, and microbially induced corrosion/metal microbe interaction. The Division programs are designed to be responsive to and to anticipate Naval needs. Transition of Division products to the DoD, Navy systems developers, operational Navy, and civilian (dual use) programs is a primary goal. The Division's programs are coordinated and interactive with other NRL programs and activities, ONR's research programs, and other government agencies involved in oceanographic activities. The Division also collaborates and cooperates with scientists from the academic community and other U.S. and foreign laboratories.

**Personnel:** 83 full-time civilian; 1 full-time military

## Key Personnel

| Title | Code |
|---|---|
| Superintendent, Oceanography Division | 7300 |
| Associate Superintendent | 7301 |
| Administrative Officer | 7302 |
| Office of the Senior Scientist for Marine Molecular Processes | 7303 |
| Office of the Senior Scientist for Ocean Modeling and Prediction | 7304 |
| Military Deputy | 7305 |
| Head, Ocean Dynamics and Prediction Branch | 7320 |
| Head, Ocean Sciences Branch | 7330 |

**Point of contact:** Code 7302, (228) 688-4114; DSN 828-4114

# Marine Geosciences Division

## Code 7400
## Research Activity Areas

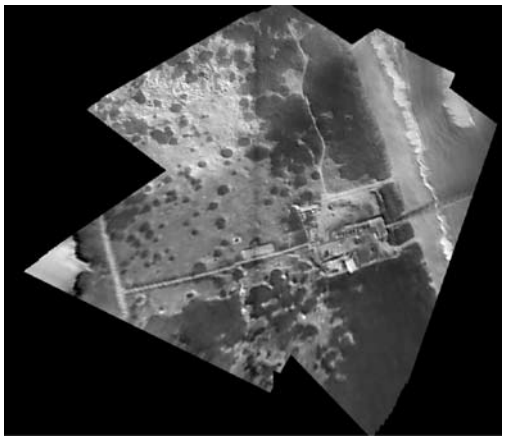
### Marine Geology
- Sedimentary processes
- Sediment microstructure
- Pore fluid flow
- Diapirism, volcanism, faulting, mass movement
- Biogenic and thermogenic methane
- Hydrate distribution, formation, and dissociation
- Small scale granular/fluid dynamics

### Marine Geophysics
- Seismic wave propagation
- Physics of low-frequency acoustic propagation
- Acoustic energy interaction with topography and inhomogeneities
- Gravimetry and geodesy
- Geomagnetic modeling

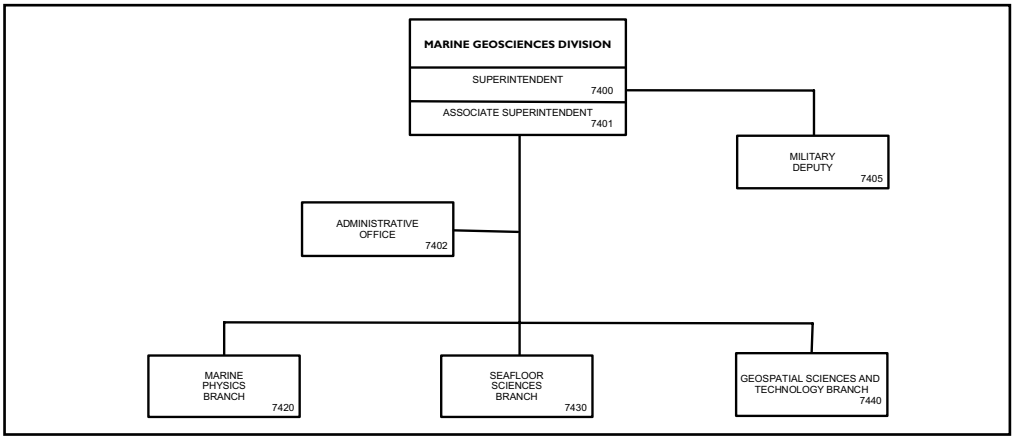
### Marine Geotechnique
- Acoustic seafloor characterization
- Geoacoustic modeling
- Geotechnical properties and behavior of sediments
- Measurement and modeling of high-frequency acoustic propagation and scattering
- Mine burial processes
- Marine biogeochemistry
  - Animal-microbe-sediment interactions
  - Early sediment diagenesis
- Sedimentary microbial respiration of manganese and iron

### Geospatial Sciences and Technology
- Digital database design
- Digital product analysis and standardization
- Data compression techniques and exploitation
- Hydrographic survey techniques
- Bathymetry extraction techniques from remote and acoustic imagery
- Modeling of nearshore morphodynamics
- Geospatial portal design with 2D and 3D interfaces
- Characterization of the littoral from airborne platforms

### In Situ and Laboratory Sensors
- High-resolution subseafloor 2D and 3D seismic imaging
- Laser/hyperspectral bathymetry/topography
- Swath acoustic backscatter imaging
- Sediment pore water pressure, permeability, and undrained shear strength
- Compressional and shear wave velocity and attenuation
- Airborne geophysics, gravity, and magnetics
- Seafloor magnetic fluctuation
- Sediment microfabric change with pore fluid and/or gas change
- Instrumented mine shapes
- Bottom currents and pressure fluctuations



Georectified mosaic of Field Research Facility in Duck, NC automatically created from the video of a Raven Unmanned Aircraft System (UAS). Efficient mapping algorithms have been developed to create rectified movies to allow exploitation of this type video to determine littoral processes including waves, currents, and bathymetry.




## Basic Responsibilities

The Marine Geosciences Division conducts a broadly based, multidisciplinary program of scientific research, advanced technology development, and applied research in marine geosciences, geodesy, geospatial information, and related technologies. This includes investigations of basic processes within ocean basins, littoral regions and adjacent land areas and arctic regions; development of models, sensors, and techniques; and the exploitation of this knowledge and technology to enhance Navy and Marine Corps systems, plans, and operations, and to meet national needs.

As the Navy's subject matter expert in the areas of Geospatial Information and Services (GI&S), the Division provides vital technical support to the Oceanographer/Navigator of the Navy, CNO, N2/N6F5, the National Geospatial-Intelligence Agency (NGA) and the Tri-Service Community. NRL also contributes to the development of leading-edge geospatial technology by reviewing emerging GI&S standards and products.

Close coordination and interactions with the Commander, Naval Meteorology and Oceanography Command, Naval Oceanographic Office, CNO, Office of Naval Research (ONR), Systems Commands, Warfare Centers, NGA, and the other DoD and national organizations are essential to the success of Division programs, with transition of Division technology to systems developers and to the operational Navy a primary goal. The Division program is coordinated and interactive with other NRL programs and activities, ONR's Research Program Department, NOAA, USGS, NSF, and other government agencies involved in seafloor activities. The Division collaborates and cooperates with scientists from the academic community, other U.S. and foreign laboratories, and industry.

**Personnel:** 62 full-time civilian; 2 full-time military

## Key Personnel

| Title | Code |
|---|---|
| Superintendent, Marine Geosciences Division | 7400 |
| Associate Superintendent | 7401 |
| Administrative Officer | 7402 |
| Military Deputy | 7405 |
| Head, Marine Physics Branch | 7420 |
| Head, Seafloor Sciences Branch | 7430 |
| Head, Geospatial Sciences and Technology Branch | 7440 |

**Point of contact:** Code 7402, (228) 688-4660; DSN 828-4660

# Marine Meteorology Division

## Code 7500
## Research Activity Areas

### Atmospheric Dynamics and Prediction
- Global to tactical scale
- Deterministic and probabilistic
- Large eddy simulation
- Boundary layer
- Land surface
- Coastal
- Arctic
- Urban effects
- Massively parallel computing
- Coupled ocean/atmosphere
- Tropical cyclones
- Aerosols
- Topographically forced flow
- Predictability
- Ensembles design
- Advanced numerical methods

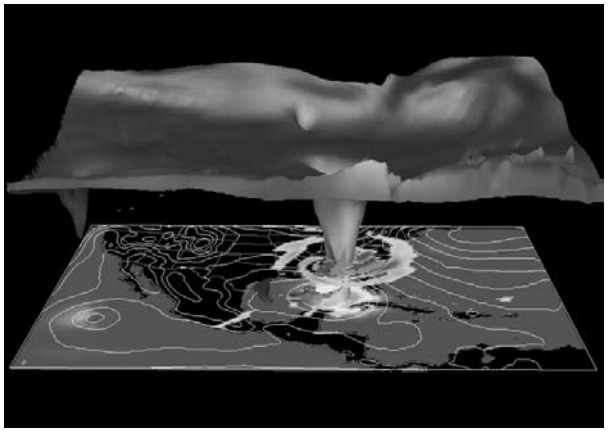
### Data Assimilation
- Hybrid techniques
- 3D and 4D variational analysis
- Ensemble Transform Kalman Filter (ETKF)
- Quality control and bias correction
- Tropical cyclone initialization
- Remotely sensed data assimilation
- Adjoint applications
- Direct radiance assimilation
- Radar data assimilation
- Targeted observations
- Data selection techniques
- Aerosol assimilation
- UAV data assimilation

### Tactical Environmental Support
- Rapid environmental assessment
- Through-the-sensor measurements
- Atmospheric impact on weapons systems
- Chem-bio transport and dispersion
- Data fusion
- Nowcasting
- Visualization
- Port studies
- Typhoon havens
- Forecaster handbooks
- Expert systems
- Aviation risk assessment
- Quantification of uncertainty

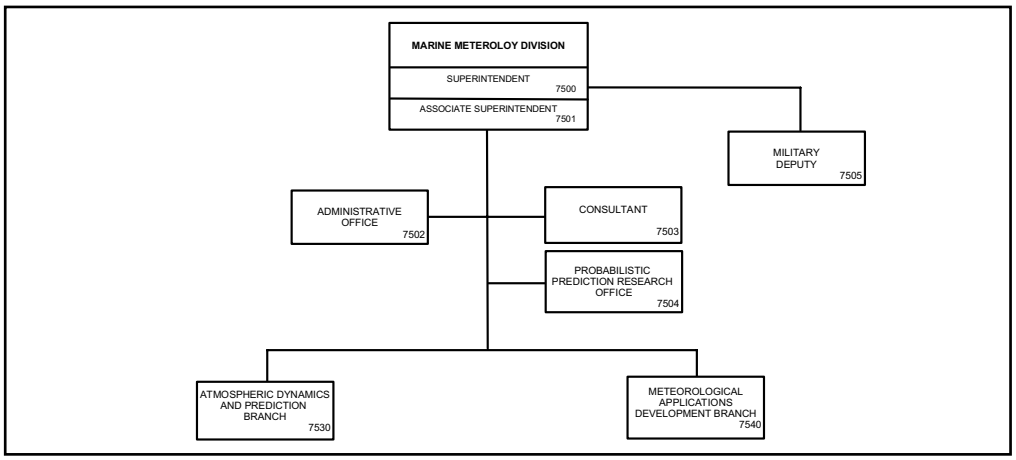
### Atmospheric Physics
- Air-sea interaction
- Cloud and aerosol microphysics
- Radiative transfer
- Aerosol characterization
- Tropical cyclone structure

### Satellite Data/Imagery
- Automated cloud properties
- Sensor calibration/validation
- Satellite imagery analysis and enhancement
- Multisensor data fusion
- Tropical cyclone characterization
- Dust/aerosols
- Rain rate and snow cover
- Nighttime environmental analysis
- NPOESS preparation
- Tactical meteorology

### Decision Aids
- Refractivity/ducting
- Ceiling/visibility
- Fog/turbulence/icing
- Atmospheric acoustics
- EM/EO propagation effects
- Tropical cyclones/consensus forecasts
- Nuclear/chemical/biological transport and dispersion



A 3D depiction of forecast sensitivity based on a COAMPS model forecast of Katrina, obtained using the model's adjoint and tangent linear model system. The sea-level pressure (white contours) and 10-m wind speed (color) are shown at the surface. The sensitivity of the energy in a box surrounding Katrina to the previous 24-h model vorticity at 2.5 km is shown in color elevated above the surface. The 3D surface corresponding to the equivalent potential temperature of 340 K, shaded by wind speed, is also displayed.




## Basic Responsibilities

The Marine Meteorology Division conducts a basic and applied research and development program designed to improve scientific understanding of atmospheric processes that impact Fleet operations and to develop automated systems that analyze, simulate, predict, and interpret the structure and behavior of these processes and their effect on naval weapons systems. Basic and applied research includes work in air-sea interaction, aerosol and cloud physics, atmospheric turbulence, orographically forced flow, atmospheric predictability, scale interactions observation impact, advanced data assimilation, ensemble prediction, tropical dynamics, and numerical methods. Research and development ranges from development of atmospheric analysis/forecast systems and satellite data products to the development of tactical decision aids for operations support. Interdisciplinary research supports the development of coupled analysis/forecast systems, including components for ocean, wave, land surface, aerosol, chemistry, and middle atmosphere prediction. NRL-Monterey (NRL-MRY) is co-located with the Fleet Numerical Meteorology and Oceanography Center (FNMOC) and has developed and transitioned to FNMOC the data assimilation, global and mesoscale weather forecast models, aerosol prediction systems, and satellite applications products that form the backbone of the Navy's worldwide environmental forecasting capability. Specialties of the Division include numerical weather prediction, data assimilation, tropical cyclones, marine boundary layer processes, aerosols, rapid environmental assesssment, environmental decision aids, and satellite data analysis, interpretation, and application.

**Personnel:** 73 full-time civilian; 1 full-time military

## Key Personnel

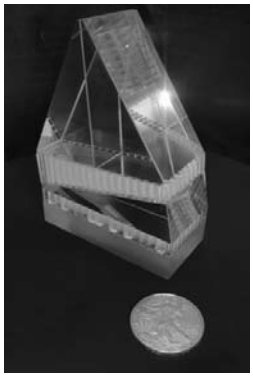
| Title | Code |
|---|---|
| Superintendent, Marine Meteorology Division | 7500 |
| Associate Superintendent | 7501 |
| Administrative Officer | 7502 |
| Lead Scientist, Probabilistic Prediction Research Office | 7504 |
| Military Deputy | 7505 |
| Head, Atmospheric Dynamics and Prediction Branch | 7530 |
| Head, Meteorological Applications Development Branch | 7540 |

**Point of contact:** Code 7500, (831) 656-4721; DSN 878-4721

# Space Science Division

## Code 7600
## Research Activity Areas

### Upper Atmospheric Physics
Research of composition, electromagnetic spectrum, and other physical properties of middle and upper atmospheres of the Earth and planets, both theoretically and experimentally.

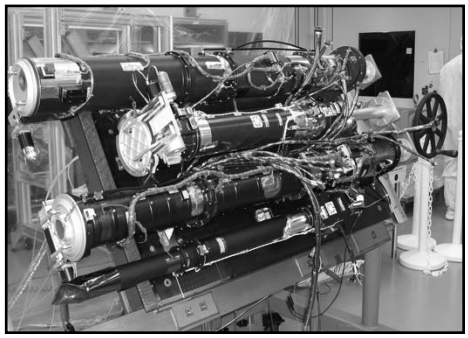


First monolithic Doppler Asymmetric Spatial Heterodyne Spectroscopy (DASH) interferometer. DASH is an innovative, advanced optical technique that can be used to measure winds in the middle and upper atmosphere of Earth and on other planets.

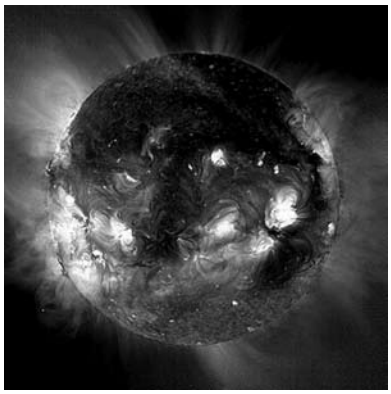
### High Energy Space Environment
Research of energetic particle, γ-ray, and X-ray/ultraviolet environments in space and for other applications of interest to the DoD, homeland security, and national programs, such as detection and surveillance of nuclear materials in terrestrial and space applications.

GLAST launched at 12:05 PM EDT on 11 June 2008 from Cape Canaveral Air Force Station on a Delta II 7920-10 rocket. After on-orbit checkout and commissioning, the Observatory was renamed the Fermi Gamma-ray Space Telescope in honor of Enrico Fermi.

### Solar Physics
Research of varying solar phenomena, the radiative and particulate emissions associated with the phenomena, and the responses of the heliosphere, and the Earth's ionosphere and thermosphere to the phenomena.

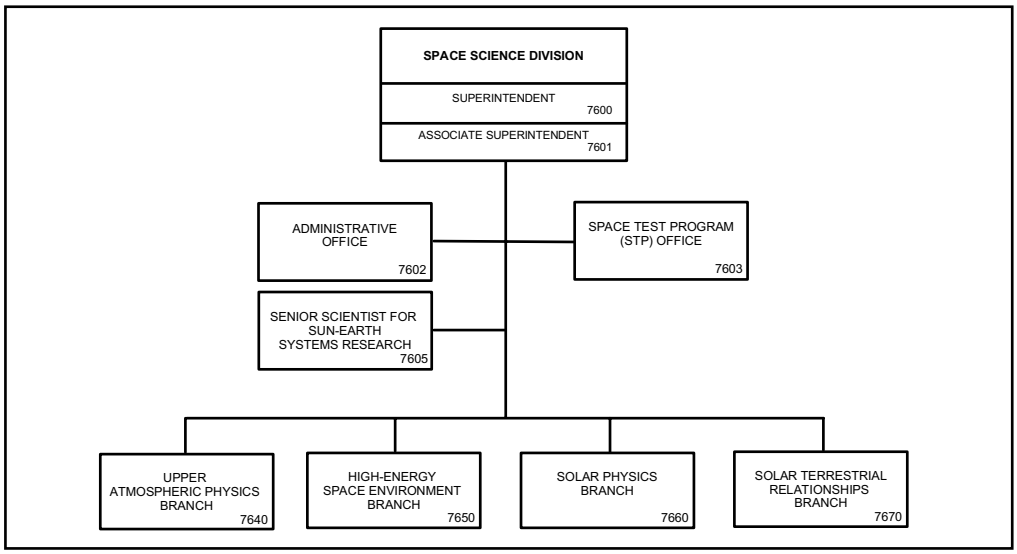


SECCHI: The Sun-Earth Connection and Heliospheric Investigation instrument suite, shown during testing at NRL, is returning spectacular stereo imagery of the region between the Sun and the Earth.



Solar image taken with the Extreme Ultraviolet Imaging Telescope (EIT) on the Solar and Heliospheric Observatory (SOHO) spacecraft. The bright areas are active regions above sunspots, and the dark areas are coronal holes where the open magnetic structure allows the fast solar wind to flow freely out into space.

### Solar-Terrestrial Relationships
Research of the emission and interplanetary transport of solar electromagnetic and particle radiation and effects on the magnetosphere, ionosphere, and atmosphere.




## Basic Responsibilities

The Space Science Division conducts a broad-spectrum RDT&E program in solar-terrestrial physics, astrophysics, upper/middle atmospheric science, and astronomy. Instruments to be flown on satellites, sounding rockets and balloons, and ground-based facilities and mathematical models are conceived and developed. Researchers apply these and other capabilities to the study of the atmospheres of the Sun and Earth, including solar activity and its effects on the Earth's ionosphere, upper atmosphere, and middle atmosphere; laboratory astrophysics; and the unique physics and properties of celestial sources. The science is important to orbital tracking, radio communications, and navigation that affect the operation of ships and aircraft, utilitization of the near-space and space environment of the Earth, and the fundamental understanding of natural radiation and geophysical phenomena.

**Personnel:** 81 full-time civilian; 1 full-time military

## Key Personnel

| Title | Code |
|---|---|
| Superintendent, Space Sciences Division | 7600 |
| Associate Superintendent | 7601 |
| Administrative Officer | 7602 |
| Space Test Program Officer, Kirtland AFB, NM | 7603 |
| Head, Sun-Earth Systems Research | 7605 |
| Head, Upper Atmospheric Physics Branch | 7640 |
| Head, High-Energy Space Environment Branch | 7650 |
| Head, Solar Physics Branch | 7660 |
| Head, Solar Terrestrial Relationships Branch | 7670 |

**Point of contact:** Code 7602, (202) 767-3248

# Naval Center for Space Technology

# NAVAL CENTER FOR SPACE TECHNOLOGY

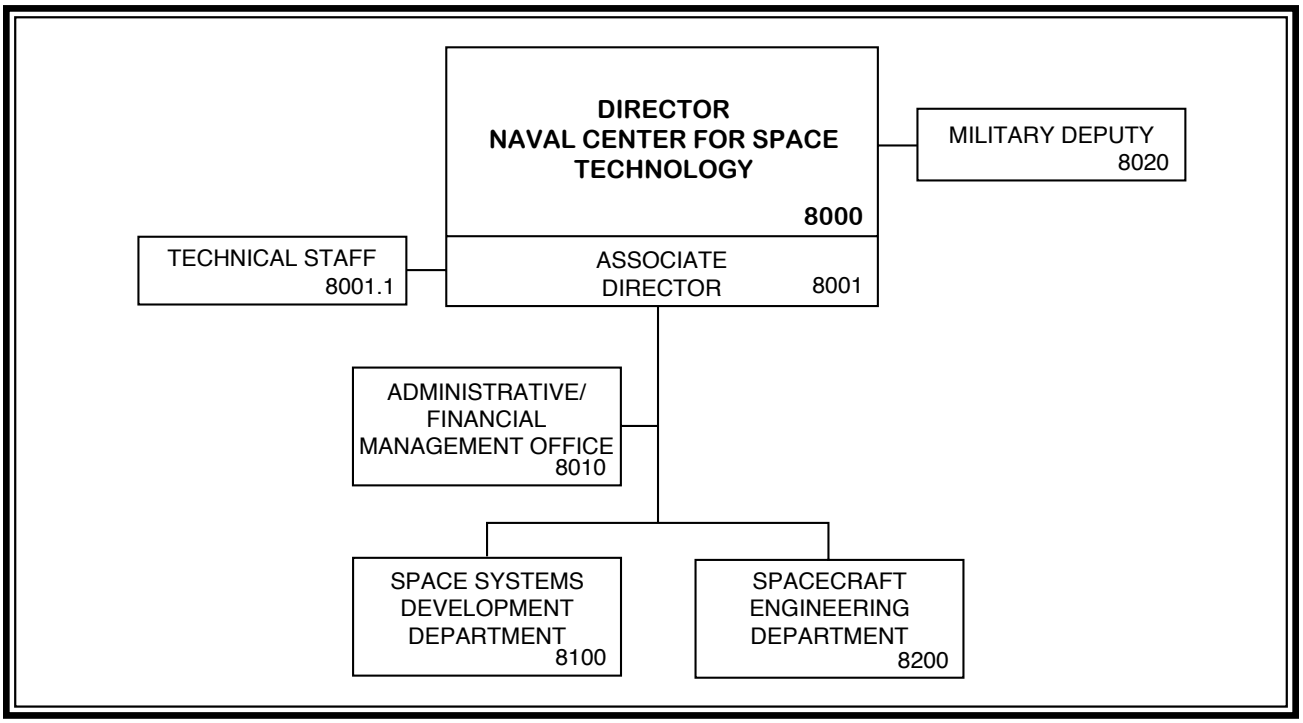
## Code 8000

In its role to preserve and enhance a strong space technology base and provide expert assistance in the development and acquisition of space systems that support naval missions, the Naval Center for Space Technology performs basic and applied research through advanced development in all areas of interest to the Navy space program. The Center develops spacecraft, systems using these spacecraft, and ground command and control stations. Principal functions of the Center include understanding and clarifying requirements, recognizing and prosecuting promising research and development, analyzing and testing systems to quantify their capabilities, developing operational concepts that exploit new technical capabilities, performing system engineering to allocate design requirements to subsystems, and performing engineering development and initial operation to test and evaluate selected spacecraft subsystems and systems. The Center is a focal point and integrator for those divisions at NRL whose technologies are used in space systems. The Center also provides systems engineering and technical direction assistance to system acquisition managers of major space systems. In this role, technology transfer is a major goal and motivates a continuous search for new technologies and capabilities and the development of prototypes that demonstrate the integration of such technologies.

# Director of Naval Center for Space Technology

**Mr. P.G. Wilhelm** was born in New York City. He attended Purdue University, where he received a B.S.E.E. degree in 1957. By 1961, he had completed all the course work for an M.S.E. degree from George Washington University.
From 1957 to 1959, Mr. Wilhelm served as an electrical engineer with Stewart Warner Electronics where he was assigned to a project to redesign the UPM-70, a Navy radar test set. In March 1959, he joined the Naval Research Laboratory as an electrical scientist in the Electronics Division. In December 1959, he joined the Satellite Techniques Branch. In 1961, he became Head of the Satellite Instrument Section; in 1965, he became Head of the Satellite Techniques Branch; and in 1974, Head of the Spacecraft Technology Center. In these positions, he performed satellite system design, equipment development, environmental testing, launch operations, and orbital data handling. In 1981, he was named Superintendent of the Space Systems and Technology Division, the Navy's principal organization, or lead laboratory, for space. He is credited with contributions in the design, development, and operation of more than 92 scientific and Fleet-support satellites. He has been awarded five patents. In October 1986, he was appointed Director of the newly established Naval Center for Space Technology. The Center's mission is to "preserve and enhance a strong space technology base and provide expert assistance in the development and acquisition of space systems which support naval missions."

Mr. Wilhelm has been recognized with numerous awards including the Navy's Meritorious Civilian Service Award, the DoD Distinguished Civilian Service Award, the Presidential Meritorious Executive Award, the Presidential Distinguished Rank Award, the Institute of Electrical and Electronics Engineers Aerospace and Electronic Systems Group Man of the Year Award, the NRL E.O. Hulburt Annual Science and Engineering Award, the Dexter Conrad Award, the Rotary National Stellar Award, the NRL Lifetime Achievement Award, and in May 1999, Mr. Wilhelm received the American Institute of Aeronautics and Astronautics (AIAA) Goddard Astronautics Award. He also has been elected a Fellow of the Washington Academy of Sciences and a Fellow of the American Institute of Aeronautics and Astronautics, and was elected to the National Academy of Engineering. Mr. Wilhelm is also the first recipient of the R.L. Easton Award for excellence in engineering.




## Key Personnel

| Name | Title | Code |
|---|---|---|
| Mr. P.G. Wilhelm | Director, Naval Center for Space Technology | 8000 |
| Vacant | Associate Director | 8001 |
| Vacant | Technical Staff | 8001 |
| Mr. S.M. Prior | Head, Administrative/Financial Management Office | 8010 |
| CDR M.H. Sanders | Military Deputy | 8020 |
| Mr. C. Dwyer | Superintendent, Space Systems Development Department | 8100 |
| Mr. J.P. Schaub | Superintendent, Spacecraft Engineering Department | 8200 |

**Point of contact:** Code 8010, (202) 767-6550

# Space Systems Development Department

## Code 8100
## Research Activity Areas

### Advanced Space/Airborne/Ground Systems Technologies
- Space systems architectures and requirements
- Advanced payloads and optical communications
- Controllers, processors, signal processing, and VLSI data management systems and equipment
- Embedded algorithms and software
- Satellite laser ranging

### Astrodynamics
- Precision orbit estimation
- Onboard autonomous navigation
- Onboard orbit propagation
- GPS space navigation
- Satellite coverage and mission analysis
- Geolocation systems
- Orbit dynamics
- Interplanetary navigation

### Command, Control, Communications, Computers, Intelligence, Surveillance, and Reconnaissance
- Communications theory and systems
- Satellite ground station engineering and implementation
- Transportable and fixed ground antenna systems
- High-speed fixed and mobile ground data collection, processing, and dissemination systems
- Tactical communication systems

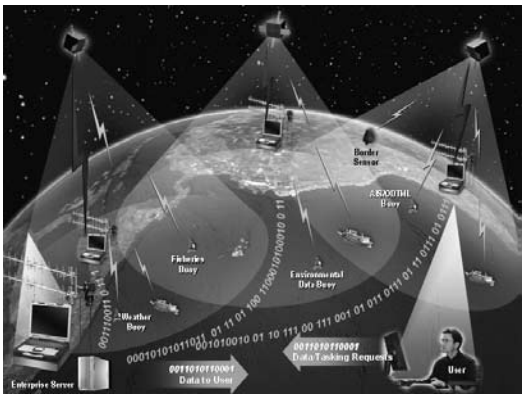
SEALINK Advanced Analysis (S2A) provides global, persistent, cooperative and non-cooperative maritime vessel tracking awareness and information that is valuable to intelligence analysis, joint warfighters, senior decision makers, and interagency offices within the SCI community.

### Space and Airborne Payload Development
- Space and airborne system payload concept definition, design, and implementation including hardware and software
- Detailed electrical/electronic design of electronic and electromechanical payload and systems and components
- Design and verification of real-time embedded multiprocessor software
- Payload antenna systems
- Space and airborne payload fabrication, test, and integration
- Launch and on-orbit payload support

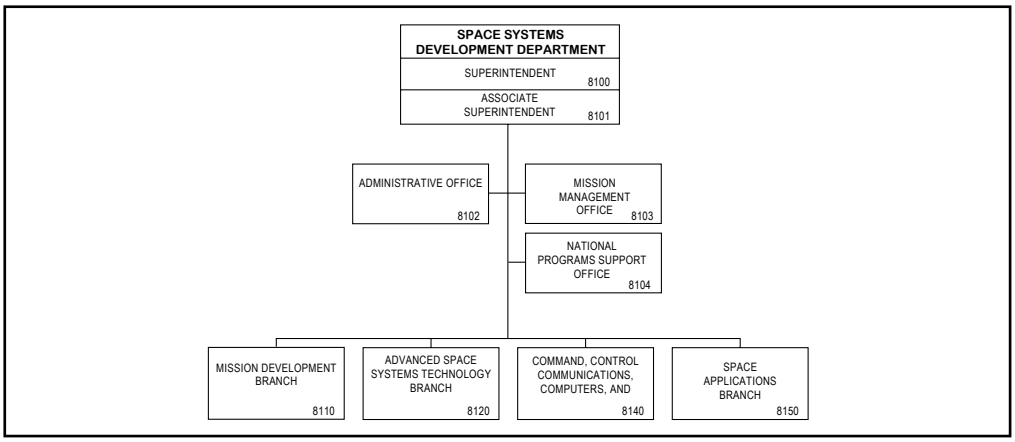
### Laser Communications Research
- Ship-to-ship laser communications
- Space-to-ground laser communications
- Satellite laser ranging for precise orbit determination

### Space and Airborne Mission Development
- Mission development and requirements definition
- Systems engineering and analysis
- Concepts of operations and mission simulations
- Mission evaluation and performance assessments

### Precision Navigation and Time
- Advanced navigation satellite technology
- Precise Time and Time Interval (PTTI) technology
- Atomic time/frequency standards/instrumentation
- Passive and active ranging techniques
- Precision tracking of orbiting objects from space/ground
- National and International standards for timekeeping/ Universal Coordinated Time/UTC (NRL)




The Global Awareness and Data Extraction International Satellite (GLADIS) is a system of 30 satellites designed to achieve expanded global situational awareness and information sharing.




## Basic Responsibilities

The Space Systems Development Department (SSDD) is the space and ground support systems research and development organization of the Naval Center for Space Technology. The primary objective of the SSDD is to develop Command, Control, Communications, Computers, and Intelligence, Surveillance, and Reconnaissance hardware and software solutions to space, airborne, and ground applications to respond to Navy, DoD, and national mission requirements with improved performance, capacity, reliability, efficiency, and/or life cycle cost. The Department must derive system requirements from the mission, develop architectures in response to these requirements, and design and develop systems, subsystems, equipment, and implementation technologies to achieve the optimized, integrated operational space, airborne, and ground system. These development responsibilities extend across the entire space/airborne/ground spectrum of hardware, software, and advanced technologies, including digital processing and control, analog systems, power, communications, payload command and telemetry, radio frequency, optical, payload, and electromechanical systems, as well as systems engineering.

**Personnel:** 124 full-time civilian; 1 part-time civilian; 20 student civilian; 1 intermittent civilian

## Key Personnel

| Title | Code |
|---|---|
| Superintendent, Space Systems Development Department | 8100 |
| Associate Superintendent | 8101 |
| Administrative Officer | 8102 |
| Head, Mission Management Office | 8103 |
| Head, National Programs Support Office | 8104 |
| Head, Mission Development Branch | 8110 |
| Head, Advanced Space Systems Technology Branch | 8120 |
| Head, Command, Control, Communications, Computers, and Intelligence Branch | 8140 |
| Head, Space Applications Branch | 8150 |

**Point of contact:** Code 8102, (202) 767-0432

# Spacecraft Engineering Department

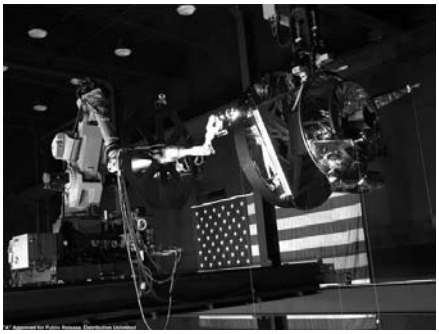
## Code 8200
## Research Activity Areas

### Design, Test, and Processing
Design, fabrication, and testing of spacecraft and hardware
Preliminary and detailed design, fabrication, testing, and integration onto launch vehicle
Systems engineering for new spacecraft proposals
Start-to-finish responsibility for NCST spacecraft mechanical systems

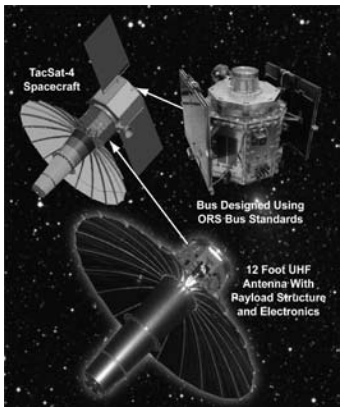
### Space Mechanical Systems Development
Research and development in spacecraft technology
Conceptual design trade studies
Integrated engineering design and analysis
Structural and thermal design and analysis
Development and transition of prototype hardware
Development and integration of experimental pay loads
Mission integration and development

### Control Systems
Attitude determination and control systems
Precision pointing
Optical line-of-sight stabilization
Propulsion systems
Precision cleaning and component testing
Propellent and pressurization systems
Hydraulic and pneumatics control
Test systems and services
Analytical design and mission planning
Navigation, tracking, and orbit dynamics
Expert systems
Flight operations support
Computer simulation
Computer animation
Robotics systems engineering
Proximity operations
Autonomous servicing
Autonomous inspection
End effector design
Compliance control
Trajectory planning
Machine vision
Fault detection, isolation, and recovery

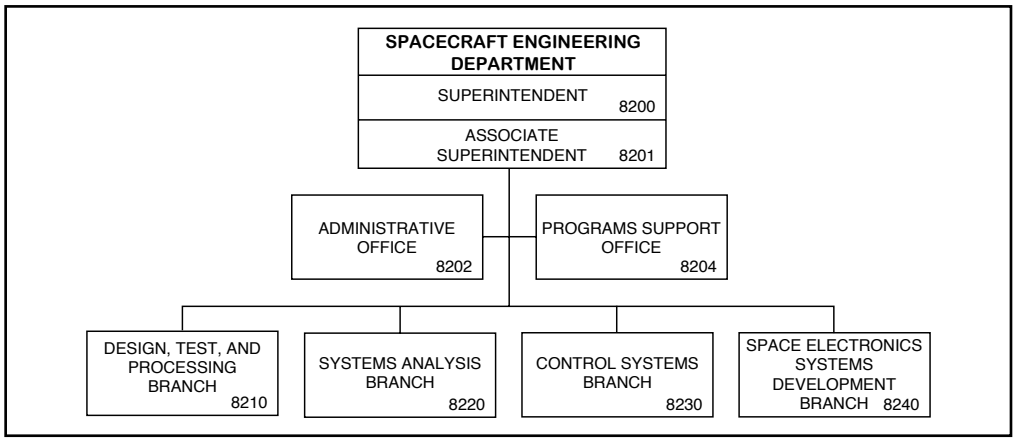
### Space Electronic Systems Development
Space system concept definition, design, and implementation including hardware and software
Detailed electrical/electronic design of electronic and electromechanical systems and components
Implementation of real-time flight software and embedded command, control, and telemetry software
Design and verification of real-time embedded multiprocessor software
Spacecraft antenna systems
Space systems fabrication, test, and integration
Launch and on-orbit support
Space test systems and electronic launch support equipment
Space TT&C and control systems
Space communication systems



The Space Robotics Laboratory employs two six-degree-of-freedom robotic manipulators to perform realistic orbital and attitude motion simulations for proximity operations of spacecraft. This facility enables hardware-in the-loop testing of machine vision systems, capture mechanisms and autonomous guidance, navigation, and control algorithms. The resulting technologies will benefit future DoD space missions involving autonomous rendezvous and capture.




TacSat-4 is a Navy-led joint mission to provide operationally relevant capabilities and enable Operationally Responsive Space (ORS). TacSat-4 provides 10 ultra high frequency channels that can be used for any combination of communications, data exfiltration, or Blue Force tracking. Notably, TacSat-4 provides communications on-the-move with legacy radios and provides a wideband "MOUS-like" channel for early testing. The unique orbit augments geosynchronous communications by allowing near-global, but not continuous, coverage including the high latitudes. TacSat-4 also advances ORS development areas including spacecraft bus standards, long dwell orbits, dynamic tasking, and net-centric operations. TacSat-4 spacecraft will be completed in Fall 2008 for launch in Fall 2009.




## Basic Responsibilities

The Spacecraft Engineering Department (SED) is the focal point for the Navy's capability to design and build spacecraft. Activities range from concept and feasibility planning to on-orbit IOC for NRL's space systems.

The SED provides spacecraft bus expertise for the Navy and maintains an active in-house capability to develop satellites; manages Navy space programs through engineering support and technical direction; in concert with the Space Systems Development Department, designs, assembles and tests spacecraft and space experiments, including all aspects of space, launch, and ground support; analyzes and designs structures, mechanisms, and a variety of control systems, including attitude, propulsion, reaction, and thermal; integrates satellite designs, launch vehicles, and satellite-to-boost stages; functions as a prototype laboratory to ensure that designs can be transferred to industry and incorporated into subsequent satellite hardware builds; and consults with the Navy Program Office on technical issues involving spacecraft architecture, acquisition, and operation.

**Personnel:** 114 full-time civilian; 1 part-time civilian; 20 student civilian; 1 intermittent civilian

## Key Personnel

| Title | Code |
|---|---|
| Superintendent, Spacecraft Engineering Department | 8200 |
| Associate Superintendent | 8201 |
| Administrative Officer | 8202 |
| Head, Programs Support Office | 8204 |
| Head, Design, Test, and Processing Branch | 8210 |
| Head, Space Mechanical Systems Development Branch | 8220 |
| Head, Control Systems Branch | 8230 |
| Head, Space Electronics Systems Development Branch | 8240 |

**Point of contact:** Code 8202, 767-6412

# Technical Output, Fiscal, and Personnel Information

# Technical Output

## Publications, Presentations, and Patents

The Navy continues to be a pioneer in science and engineering developments and a leader in applying these advancements to military requirements. The primary means of informing the scientific and engineering community of the advances made at NRL is through the Laboratory's technical output—reports, articles in scientific journals, contributions to books, papers presented to scientific societies and topical conferences, patents, and inventions.

The figures for calendar years 2008 and 2009 presented below represent the output of NRL facilities in Washington, DC; Bay St. Louis, Mississippi; and Monterey, California.

In 1986, Congress enacted the Federal Technology Transfer Act in an effort to encourage the commercial use of technology developed in Federal laboratories. The Act allows Government inventors and the laboratories where they work to share the royalties generated by commercial licensing of their inventions. Also, the Act encourages the establishment of cooperative research and development agreements (CRADAs) between laboratories such as NRL and nonfederal entities such as state and local governments, universities, and business corporations. Such cooperative R&D agreements can include the allocation in advance of patent rights on any inventions made under the joint research effort.

The 1986 Act has given additional impetus to the Laboratory's efforts to patent important inventions arising out of its various research programs.

**Calendar Year 2008**

| Type of Contribution | Unclassified | Classified | Total |
|---|---|---|---|
| Articles in periodicals, chapters in books, and papers in published proceedings | 1261 | 0 | 1261* |
| Oral Presentations | 1529 | | 1529 |
| NRL Formal Reports | 11 | 0 | 11 |
| NRL Memorandum Reports | 65 | 4 | 69 |
| Books | 2 | 0 | 2 |
| Patents granted | 58 | | 58 |
| Statutory Invention Registrations (SIRs) | 3 | | 3 |

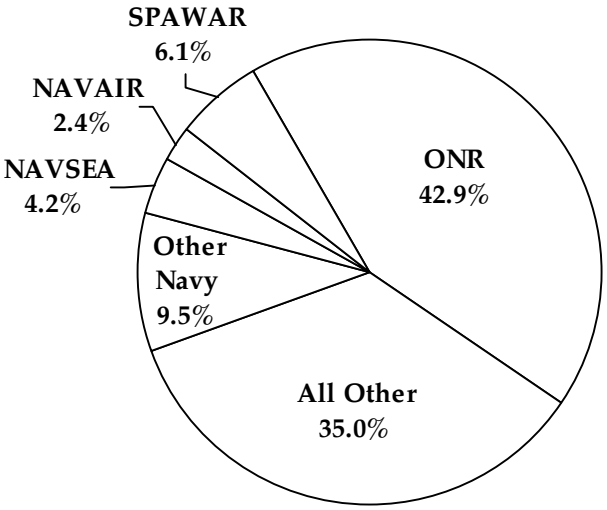
**Calendar Year 2009**

| Type of Contribution | Unclassified | Classified | Total |
|---|---|---|---|
| Articles in periodicals, chapters in books, and papers in published proceedings | 1130 | 0 | 1130* |
| Oral Presentations | 3744 | | 1529 |
| NRL Formal Reports | 8 | 5 | 13 |
| NRL Memorandum Reports | 44 | 0 | 44 |
| Books | 0 | 0 | 0 |
| Patents granted | 51 | | 51 |
| Statutory Invention Registrations (SIRs) | 0 | | 0 |

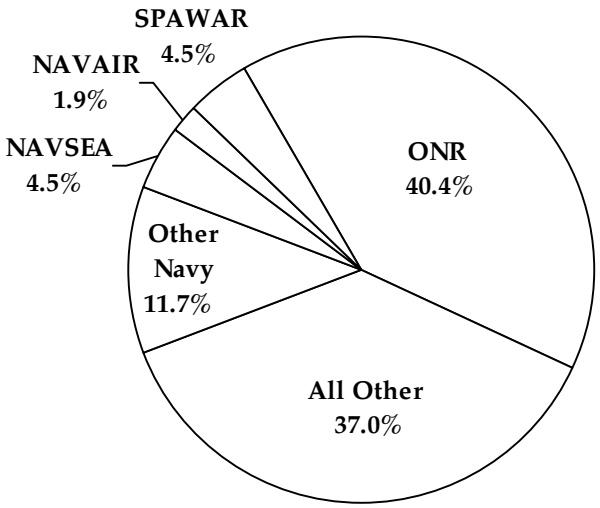
* This is a provisional total based on information available to the Ruth H. Hooker Research Library on December 17, 2009. Total includes refereed and non-refereed publications.

# FY 2008/2009 Sources of New Funds (Actual)

**FY 2008**




**FY 2009**




**FY 2008**

**Source of Funds (%)**

| FY 2008 | Reimbursable | $M Direct Cite | Total |
|---|---|---|---|
| Office of Naval Research (ONR) | 288.8 | 153.7 | 442.5 |
| Naval Sea Systems Command (NAVSEA) | 23.5 | 19.4 | 42.9 |
| Space and Naval Warfare Systems Command (SPAWAR) | 41.6 | 20.9 | 62.5 |
| Naval Air Systems Command (NAVAIR) | 8.4 | 16.6 | 25.0 |
| Other Navy | 74.1 | 24.1 | 98.2 |
| All Other | 230.9 | 130.6 | 361.4 |
| Total Funds | 667.3 | 365.3 | 1,032.6 |

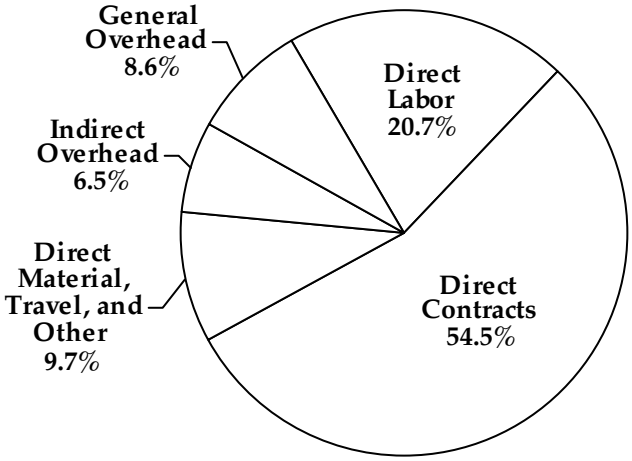
**FY 2009**

**Source of Funds (%)**

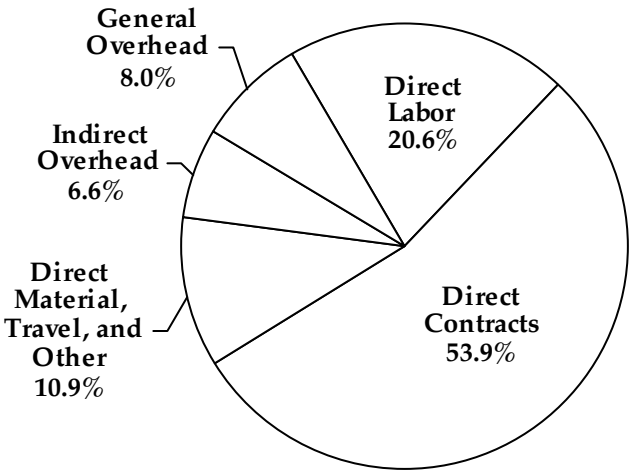
| FY 2009 | Reimbursable | $M Direct Cite | Total |
|---|---|---|---|
| Office of Naval Research (ONR) | 296.8 | 148.1 | 444.9 |
| Naval Sea Systems Command (NAVSEA) | 26.5 | 22.9 | 49.4 |
| Space and Naval Warfare Systems Command (SPAWAR) | 31.9 | 17.7 | 49.5 |
| Naval Air Systems Command (NAVAIR) | 10.0 | 10.9 | 20.9 |
| Other Navy | 66.8 | 62.6 | 129.5 |
| All Other | 265.9 | 142.1 | 408.0 |
| Total Funds | 698.0 | 404.2 | 1,102.2 |

# FY 2008/2009 Uses of Funds

**FY 2008**




**FY 2009**




**FY 2008**
**Distribution of Funds (%)**

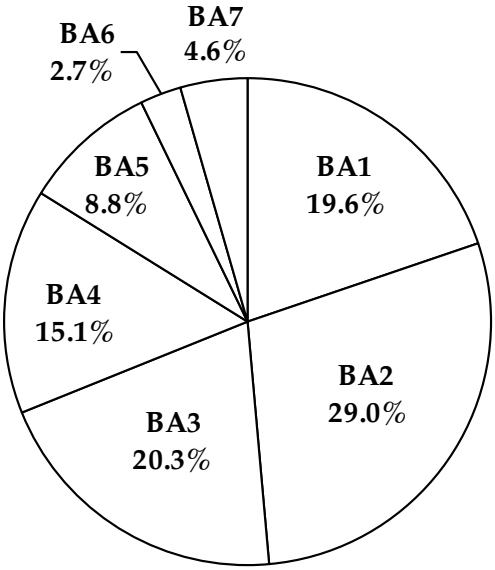
| | $M |
|---|---|
| Direct Labor | 209.4 |
| General Overhead | 87.6 |
| Indirect Overhead | 66.0 |
| Direct Material, Travel, and Other | 98.1 |
| Direct Contracts | 551.8 |
| Total Costs* | 1,012.9 |

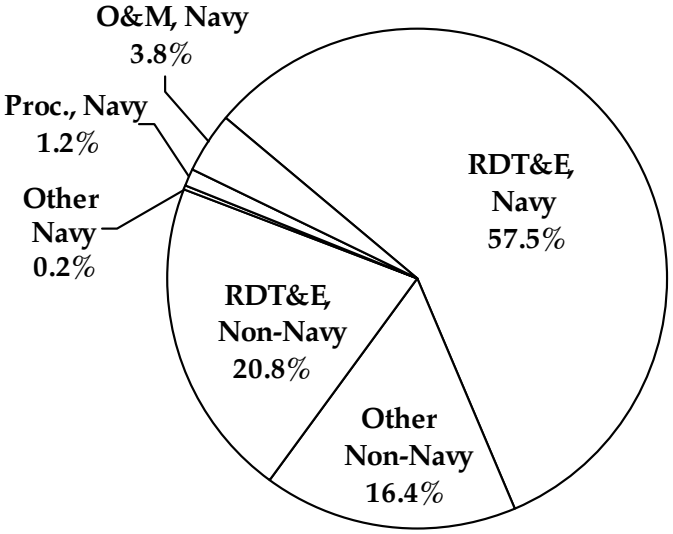
**FY 2009**
**Distribution of Funds (%)**

| | $M |
|---|---|
| Direct Labor | 219.8 |
| General Overhead | 85.8 |
| Indirect Overhead | 70.3 |
| Direct Material, Travel, and Other | 116.8 |
| Direct Contracts | 575.5 |
| Total Costs* | 1,068.3 |

*Costs based on CFO statements; direct contracts include costs for reimbursably-funded contracts and obligations for direct cite-funded contracts.

# FY 2008 Total New Funds by Category

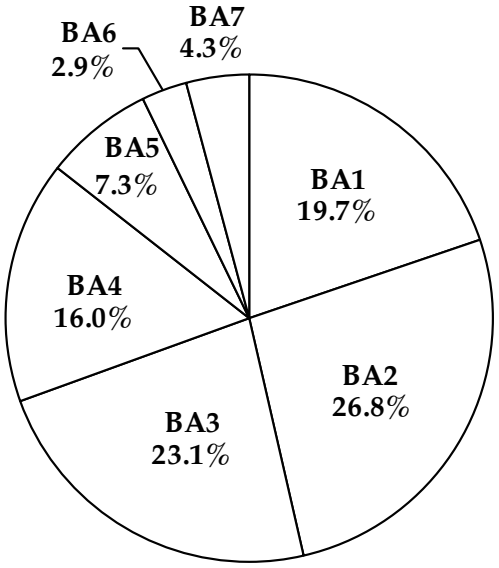


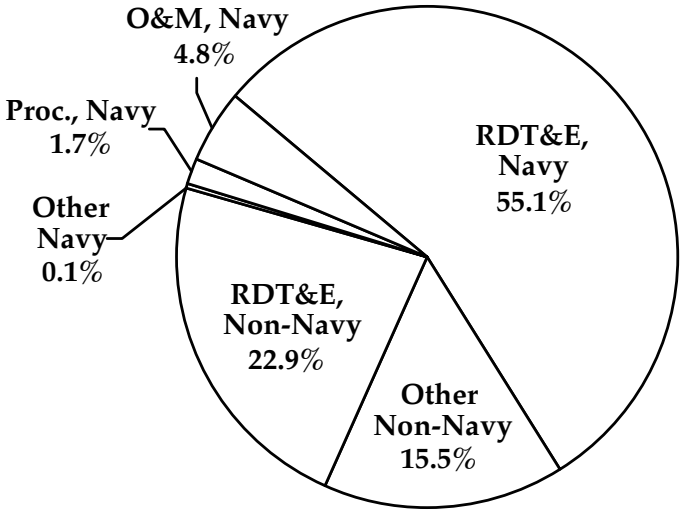




**FY 2008**

| Category | Distribution of RDT&E, Navy (%) ($593.3) | Distribution of Total (%) ($1,032.6) | |
|---|---|---|---|
| | | $M | |
| | Navy | Non-Navy | Total |
| BA1 Basic Research | 116.3 | 7.4 | 123.7 |
| BA2 Applied Research | 172.1 | 38.9 | 211.0 |
| BA3 Advanced Technology Development | 120.2 | 129.6 | 249.8 |
| BA4 Advanced Component Development Prototypes | 89.4 | 13.3 | 102.8 |
| BA5 System Development and Demonstration | 52.1 | 2.4 | 54.5 |
| BA6 RDT&E Management Support | 16.1 | 8.1 | 24.2 |
| BA7 Operational System Development | 27.1 | 15.3 | 42.4 |
| Subtotal RDT&E | 593.3 | 215.1 | 808.4 |
| Operations and Maintenance | 39.7 | 18.4 | 58.2 |
| Procurement | 12.9 | 29.1 | 42.0 |
| Other | 1.8 | 122.1 | 124.0 |
| Total New Funds | 647.8 | 384.8 | 1,032.6 |

# FY 2009 Total New Funds by Category




**FY 2009**

| Category | Distribution of RDT&E, Navy (%) ($606.8) | Distribution of Total (%) ($1,102.2) | |
|---|---|---|---|
| | | $M | |
| | Navy | Non-Navy | Total |
| BA1 Basic Research | 119.4 | 7.4 | 126.8 |
| BA2 Applied Research | 162.4 | 42.9 | 205.2 |
| BA3 Advanced Technology Development | 140.4 | 143.6 | 284.1 |
| BA4 Advanced Component Development Prototypes | 97.0 | 39.8 | 136.8 |
| BA5 System Development and Demonstration | 44.5 | 1.6 | 46.1 |
| BA6 RDT&E Management Support | 17.4 | 9.8 | 27.1 |
| BA7 Operational System Development | 25.8 | 6.9 | 32.8 |
| Subtotal RDT&E | 606.8 | 252.1 | 858.9 |
| Operations and Maintenance | 52.8 | 48.1 | 101.0 |
| Procurement | 18.4 | 38.5 | 56.9 |
| Other | 1.6 | 83.9 | 85.5 |
| Total New Funds | 679.6 | 422.6 | 1,102.2 |

# Personnel Information*

## Civilian On-Board

| | |
|---|---|
| Full-Time, Permanent (FTP) | |
| Graded | 2,147 |
| Ungraded | 94 |
| Total | 2,241 |
| Temporary, Part-Time, Intermittent (TPTI) | |
| TPTI | 321 |
| Total Civilian | 2,562 |

| | |
|---|---|
| FTP Breakdown | |
| Scientific/Engineering Professional | 1,442 |
| Scientific/Engineering Technical | 93 |
| Administrative Specialist/Professional | 344 |
| Administrative Support | 251 |
| Senior Executive Service | 23 |
| Scientific or Professional | 16 |
| General Schedule | 0 |
| Total | 2,169 |

## Military On-Board

| | |
|---|---|
| Officers | 33 |
| Enlisted | 71 |
| Total Military On-Board | 104 |
| (Military Allowance) | 110 |

## Annual Civilian Turnover Rate (%) (permanent employees only)

| | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 |
|---|---|---|---|---|---|---|---|
| Research divisions | 6.0 | 6.8 | 7.2 | 9.5 | 8.5 | 6.9 | 4.7 |
| Nonresearch areas | 8.2 | 8.2 | 8.5 | 11.0 | 13.7 | 13.3 | 7.4 |
| Entire Laboratory | 6.4 | 6.5 | 7.4 | 9.7 | 9.6 | 8.2 | 5.3 |

## Highest Academic Degrees Held by Civilian Permanent Employees

| | |
|---|---|
| Bachelors | 537 |
| Masters | 326 |
| Doctorates | 750 |

* All data is as of 30 September 2009 unless otherwise noted.

# Professional Development

# Professional Development

NRL has established programs for the professional and personal development of its employees so that they may better serve the needs of the Navy. These programs develop and retain talented people and keep them abreast of advanced technology and management skills. Graduate assistantships, fellowships, sabbatical study programs, cooperative education programs, individual college courses, and short courses for personal improvement contribute to professional development.

Programs also exist for non-NRL employees. These programs enhance research efforts by providing means for non-NRL professionals to work at the Laboratory, thereby improving the interchange of ideas, meeting critical short-term technical requirements, and providing sources for new scientists and engineers. The programs include two-year graduate fellowships, faculty and professional interchanges, undergraduate work, and introducing gifted and talented high school students to the world of technology.

## Programs for NRL Employees

NRL employees participate in hundreds of individual training events throughout the year. Many of these are presented under the auspices of the Human Resources Office as in-house courses on diverse technical subjects and management techniques.

One common study procedure is for employees to work full time at the Laboratory while taking job-related scientific courses at universities and schools in the Washington area. The training ranges from a single course to full graduate-level programs. Tuition for training is paid by NRL. The formal programs offered by NRL are described below.

### Graduate Programs

• The **Advanced Graduate Research Program** (formerly the Sabbatical Study Program, which began in 1964) enables selected professional employees to devote full time to research or pursue work in their own or a related field for one year at an institution or research facility of their choice without the loss of regular salary, leave, or fringe benefits. NRL pays all educational costs, travel, and moving expenses for the employee and dependents. Criteria for eligibility include professional stature consistent with the applicant's opportunities and experience, a satisfactory program of study, and acceptance by the facility selected by the applicant. The program is open to paraprofessional (and above) employees who have completed six years of Federal service, four years of which are required at NRL.

• The **Edison Memorial Graduate Training Program** enables employees to pursue advanced studies in their fields at local universities. Participants in this program work 24 hours each workweek and pursue their studies during the other 16 hours. The criteria for eligibility include a minimum of one year of service at NRL, a bachelor's or master's degree in an appropriate field, and professional standing in keeping with the candidate's opportunities and experience.

• To be eligible for the **Select Graduate Training Program**, employees must have a college degree in an appropriate field and must have demonstrated ability and aptitude for advanced training. Students accepted in this program devote a full academic year to graduate study. While attending school, they receive one half of their salary; and NRL pays for tuition, books, and laboratory expenses.

• The **Naval Postgraduate School** (NPS), located in Monterey, California, provides graduate programs to enhance the technical preparation of Naval officers and civilian employees who serve the Navy in the fields of science, engineering, operations analysis, and management. It awards a master of arts degree in national security affairs and a master of science degree in many technical disciplines.

NRL employees desiring to pursue graduate studies at NPS may apply for a maximum of six quarters away from NRL, with thesis work accomplished at NRL. Specific programs are described in the NPS catalog. Participants continue to receive full pay and benefits during the period of study.

• Research conducted at NRL may be used as thesis material for an advanced degree.

This original research is supervised by a qualified employee of NRL who is approved by the graduate school. The candidate should have completed the required course work and should have satisfied the language, residence, and other requirements of the graduate school from which the degree is sought. NRL provides space, research facilities, and supervision but leaves decisions on academic policy to the cooperating schools.

## Professional Development

NRL has programs, professional society chapters, and informal clubs that enhance the professional growth of employees. Some of these are listed below.

• The **Congressional Fellowship Program**, sponsored by the American Political Science Association, provides an opportunity for some of the most promising young, technically oriented Federal executives to participate in a variety of assignments designed to develop their knowledge and understanding of Congressional operations. These Fellows share activities with other members of the Congressional Fellowship Program who come mainly from journalism, law, and college teaching.

• The **LEGIS Fellows Program** provides assignments for personnel whose current or prospective positions may require working knowledge of the operations of the Congress. The Fellows receive instruction and hands-on experience in a Congressional office through training/developmental activities such as seminars, intensive briefings, and assignments on the staff of a member, committee, or support agency of the Congress in Washington, DC.

• The **Counseling Referral Service** (C/RS) helps employees to achieve optimal job performance through counseling to resolve problems such as family and work-related stress and relationship difficulties, and behavioral, emotional, and substance abuse problems that may adversely impact job performance. C/RS provides confidential assessments and short-term counseling, training workshops, and referrals to additional resources in the community. (Contact (202) 767-6857, NRL Washington, DC; (228) 688-5726, NRL Stennis Space Center; 1-800-523-5668, NRL Monterey).

• The **NRL Women in Science and Engineering (WISE) Network** is an open-membership network of scientists and engineers who meet periodically to discuss issues of common interest, host speakers, and address and sponsor projects to benefit NRL's S&T community. The primary goals of the NRL WISE Network, a merger of the NRL Women's S&T Network and the NRL WISE Chapter, are to encourage and promote professional growth among NRL scientists and engineers. One of the most successful projects initiated and sponsored by this group is the Mentor Program, which was institutionalized to provide an environment for personal and professional growth at NRL. Another recent project focused on addressing issues concerning the quality of life for scientists and engineers at NRL.

The NRL WISE Network holds regular brown bag luncheon meetings open to all NRL female and male scientists and engineers, including contractors and postdoctoral associates. (Contact the NRL WISE Network president at (202) 404-4389; or the NRL WISE Network secretary at (202) 767-4697.)

• **Sigma Xi**, the Scientific Research Society, encourages and acknowledges original investigation in scientific research. As an honor society for research scientists, individuals who have demonstrated the ability to perform original research are elected to membership in local chapters. The NRL-Edison Chapter, with several hundred members, recognizes leadership research at NRL by presenting awards annually in pure and applied science to outstanding NRL staff members. The chapter also presents a Young Investigator Award to be presented to an outstanding young NRL researcher, less than ten years outside his/her Ph.D. The NRL-Edison Chapter also sponsors lectures at NRL on a wide range of scientific topics for the entire NRL community. These lectures are delivered by scientists from all over the nation and the world. The highlight of the Sigma Xi lecture series is the Edison Memorial Lecture, traditionally featuring a world-renowned scientist. (Contact (202) 404-8626.)

• The **NRL Mentor Program** was established to provide an innovative approach to professional and career training and an environment for personal and professional growth. It is open to all NRL employees in all job series and at all sites. Mentorees are matched with successful, experienced colleagues with more technical and/or managerial experience, who can provide them with the knowledge and skills needed to maximize their contribution to the success of their immediate organization, to NRL, to the Navy, and to their chosen career fields. The ultimate goal of the program is to increase job productivity, creativity, and satisfaction through better communication, understanding, and training. NRL Instruction 12400.1 established the NRL Mentor Program and provides the policy and procedures for the program. (Contact the Workforce Development and Management Branch at (202) 404-8314.)

• Employees interested in developing effective self-expression, listening, thinking, and leadership potential are invited to join the Forum Club, a chapter of **Toastmasters International**. Members of this club possess diverse career backgrounds and talents and learn to communicate not by rules but by prac-

tice in an atmosphere of understanding and helpful fellowship. NRL's Commanding Officer and the Director of Research endorse Toastmasters. (Forum Club: contact (202) 404-4670.)

## Continuing Education

NRL employees take government sponsored college courses (undergraduate and graduate) in order to improve their skills and keep abreast of current developments in their fields.

• The Human Resources Office (HRO) at NRL offers to all employees **short courses** in a variety of program areas; Laboratory employees may attend these courses at nongovernment facilities as well. Interagency courses in management, personnel, finance, supervisory development, clerical skills, and other areas are also available.

## Technology Base

• The **Scientist-to-Sea Program** (STSP) provides increased opportunities for Navy R&D laboratory/center personnel to go to sea for several days to gain first-hand insight into operational factors affecting system design, performance, and operations on a variety of ships. For further information on the Technology Base Programs, contact (202) 767-2945.

## Equal Employment Opportunity (EEO) Programs

Equal Employment Opportunity is a fundamental NRL policy for all persons, regardless of race, color, sexual orientation, religion, national origin, age, or physical/mental disability. The EEO office's major functions include affirmative action in employment, discrimination complaint process, EEO training, advice and guidance to management on EEO policy, and the following special emphasis programs: the Federal Women's Program, the Hispanic Employment Program, the African American Employment Program, the Individuals with Disabilities Employment Program, the Asian American/Pacific Islander Employment Program, and the American Indian-Alaskan Native Employment Program.

The management and planning of diversity issues and the special emphasis programs are accomplished through the NRL Diversity Committee. The Diversity Committee serves as an advisory committee to the Commanding Officer and recomends policies, programs, and activities that encourage advancement and self-improvement for all employees. The committee educates NRL employees on diversity issues by sponsoring awareness programs and special workshops on quality of life issues pertaining to women, minorities, and persons with disabilities. They also aid in Community Outreach efforts. (Contact the EEO Office at (202) 767-2486).

In addition, the EEO Office handles the Federal Employment Opportunity Recruitment Program (FEORP). The FEORP is designed to establish, maintain, and update targeted recruitment programs to increase participation of minorities through innovative internal and external recruitment. Furthermore, it fosters relationships with minority and women's institutions and organizations.

## Other Activities

• The **Community Outreach Program** fosters programs that benefit students and other community citizens. Volunteer employees assist with and judge science fairs, give lectures, tutor, mentor, coach, and serve as classroom resource teachers. The program also sponsors African American History Month art and essay contests for local schools, student tours of NRL, and an annual holiday party for neighborhood children. Through this program NRL has partnerships with four District of Columbia public schools. (Contact the Public Affairs Office at (202) 767-2541.)

• Other programs that enhance the development of NRL employees include the **Amateur Radio Club** which is devoted to amateur and related radio communications and is open to licensed radio operators as well as others interested in radio. The wide spectrum of club activities range from vintage radio to satellite communications. A club station is available for use by all members. The club conducts annual nationally coordinated Field Day (simulated emergency) operations. The **N6AW MWR Fitness Center** accommodates NRL's employees with facilities such as basketball and volleyball courts; cardio equipment; 12 piece selectorized nautilus circuit equipment; an exercise room; table tennis, a meeting room; and women and men's showers and lockers.

# Programs for Non-NRL Employees

Several programs have been established for non-NRL employees. These programs encourage and support the participation of visiting scientists and engineers in research of interest to the Laboratory. Some of the programs may serve as stepping-stones to federal careers in science and technology. Their objective is to enhance the quality of the Laboratory's research activities through working associations and interchanges with highly capable scientists and engineers and to provide opportunities for outside scientists and engineers to work in the Navy laboratory environment. Along with enhancing the Laboratory's research, these programs acquaint participants with Navy capabilities and concerns.

## Recent Ph.D., Faculty Member, and College Graduate Programs

• The **National Research Council (NRC)/ NRL Cooperative Research Associateship Program** selects associates who conduct research at NRL in their chosen fields in collaboration with NRL scientists and engineers. Appointments are for one year (renewable for a second and sometimes a third year).

• The **American Society for Engineering Education (ASEE) Postdoctoral Fellowship Program** aims to increase the involvement of highly trained scientists and engineers in disciplines necessary to meet the evolving needs of naval technology. Appointments are for one year (renewable for a second and sometimes a third year). These competitive appointments are made by ASEE.

• The American Society for Engineering Education also administers the **Navy/ASEE Summer Faculty Research Program** for university faculty members to work for ten weeks with professional peers in participating Navy laboratories on research of mutual interest.

• The **NRL/United States Naval Academy (USNA) Cooperative Program for Scientific Interchange** allows faculty members of the U.S. Naval Academy to participate in NRL research. This collaboration benefits the Academy by providing the opportunity for USNA faculty members to work on research of a more practical or applied nature. In turn, NRL's research program is strengthened by the available scientific and engineering expertise of the USNA faculty.

• The **National Defense Science and Engineering Graduate Fellowship Program** helps U.S. citizens obtain advanced training in disciplines of science and engineering critical to the U.S. Navy. The three-year program awards fellowships to recent outstanding graduates to support their study and research leading to doctoral degrees in specified disciplines such as electrical engineering, computer sciences, material sciences, applied physics, and ocean engineering. Award recipients are encouraged to continue their study and research in a Navy laboratory during the summer.

For further information about the above programs, contact (202) 404-7450.

• The **Professional Development Program for Ensigns** assigns newly commissioned ensigns who are awaiting future training to NRL, working in areas of their own choosing commensurate with their academic qualifications. These young officers provide a fruitful summer of research assistance while gaining valuable experience in the Navy's R&D program.

For more information, contact the Military Administrative Office at (202) 767-2103.

## Professional Appointments

• **Faculty Member Appointments** use the special skills and abilities of faculty members for short periods to fill positions of a scientific, engineering, professional, or analytical nature.

• **Consultants and experts** are employed because they are outstanding in their fields of specialization, or because they possess ability of a rare nature and could not normally be employed as regular civil servants.

• **Intergovernmental Personnel Act Appointments** temporarily assign personnel from state or local government or an educational institution to the federal government (or vice versa) to improve public services rendered by all levels of government.

## Undergraduate and Graduate Student Programs

The student programs are tailored to undergraduate and graduate students to provide employment opportunities and work experience in naval research. These programs are designed to attract applicants for student and full professional employ-

ment in fields such as engineering, physics, mathematics, oceanography, meteorology, and computer science. The student employment programs are designed to help students and the educational institutions gain a better understanding of NRL's research, its challenges, and its opportunities. The employment programs for college students include the following:

• The **Student Career Experience Program** (formerly known as Cooperative Education Program) employs students in study-related occupations. The program is conducted in accordance with a planned schedule and a working agreement between NRL, the educational institution, and the student. Primary focus is on students pursuing bachelor's degrees in engineering, computer science, or the physical sciences.

• The **Student Temporary Employment Program (STEP)** enables students to earn a salary while continuing their studies and offers them valuable work experience.

• The **Summer Employment Program** employs students for the summer in paraprofessional and technician positions in engineering, physical sciences, computer sciences, and mathematics.

• The **Student Volunteer Program** helps students gain valuable experience by allowing them to voluntarily perform educationally related work at NRL.

For additional information on these undergraduate and graduate student programs, contact (202) 767-8313.

## High School Student Programs

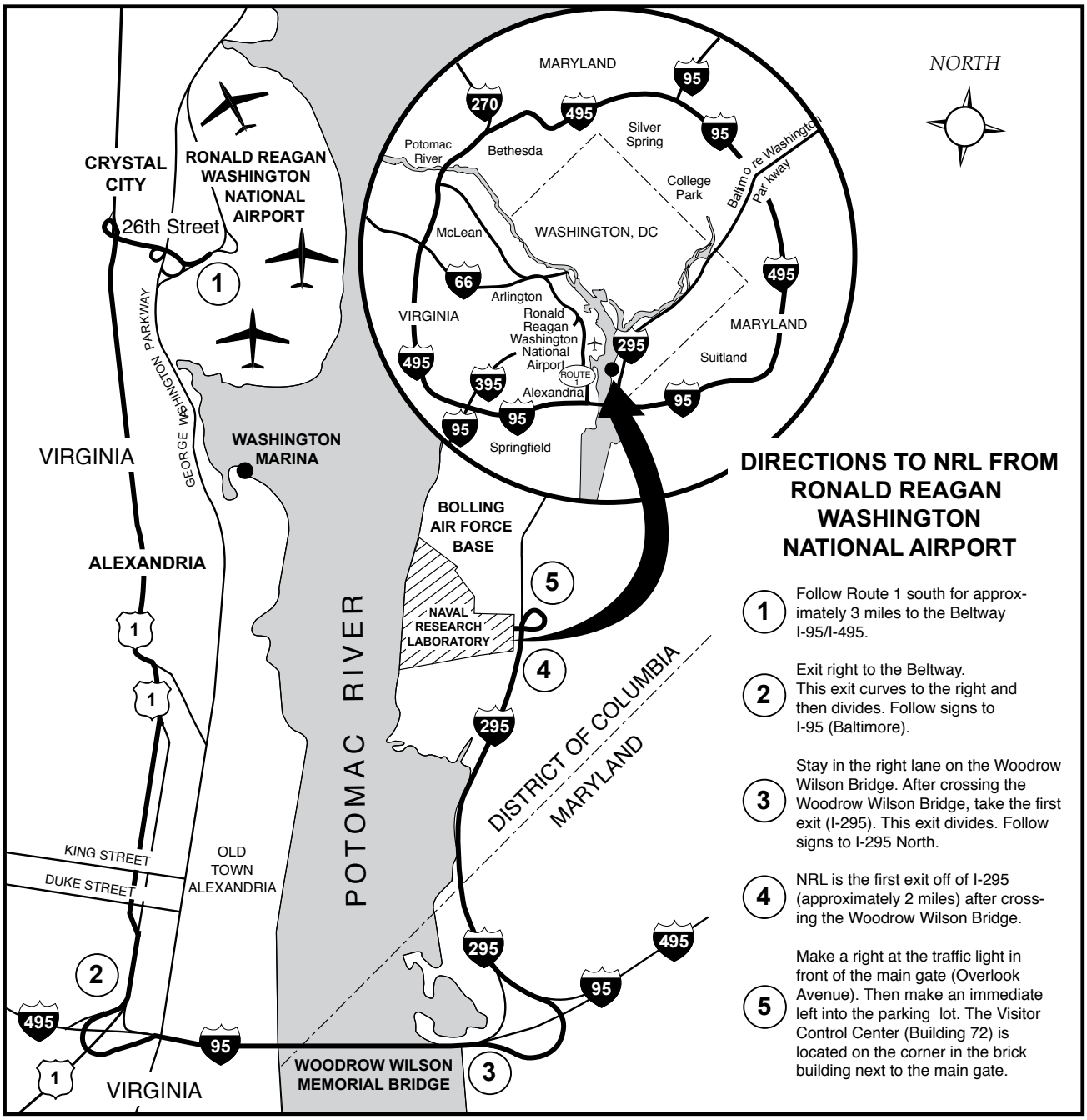
• The **DoD Science & Engineering Apprentice Program** (SEAP) employs high school juniors and seniors to serve for eight weeks as junior research associates. Under the direction of a mentor, students gain a better understanding of research, its challenges, and its opportunities through participation in scientific programs. Criteria for eligibility are based on science and mathematics courses completed and grades achieved; scientific motivation, curiosity, and capacity for sustained hard work; a desire for a technical career; teacher recommendations; and achievement test scores. The NRL program is the lead program and the largest in DoD.

Prospective mentors desiring additional information on this program, please contact the Employee Relations Branch at (202) 767-2957.

Students desiring additional information on this program may call the American Society for Engineering Education Coordinator's Office at (202) 331-3509.

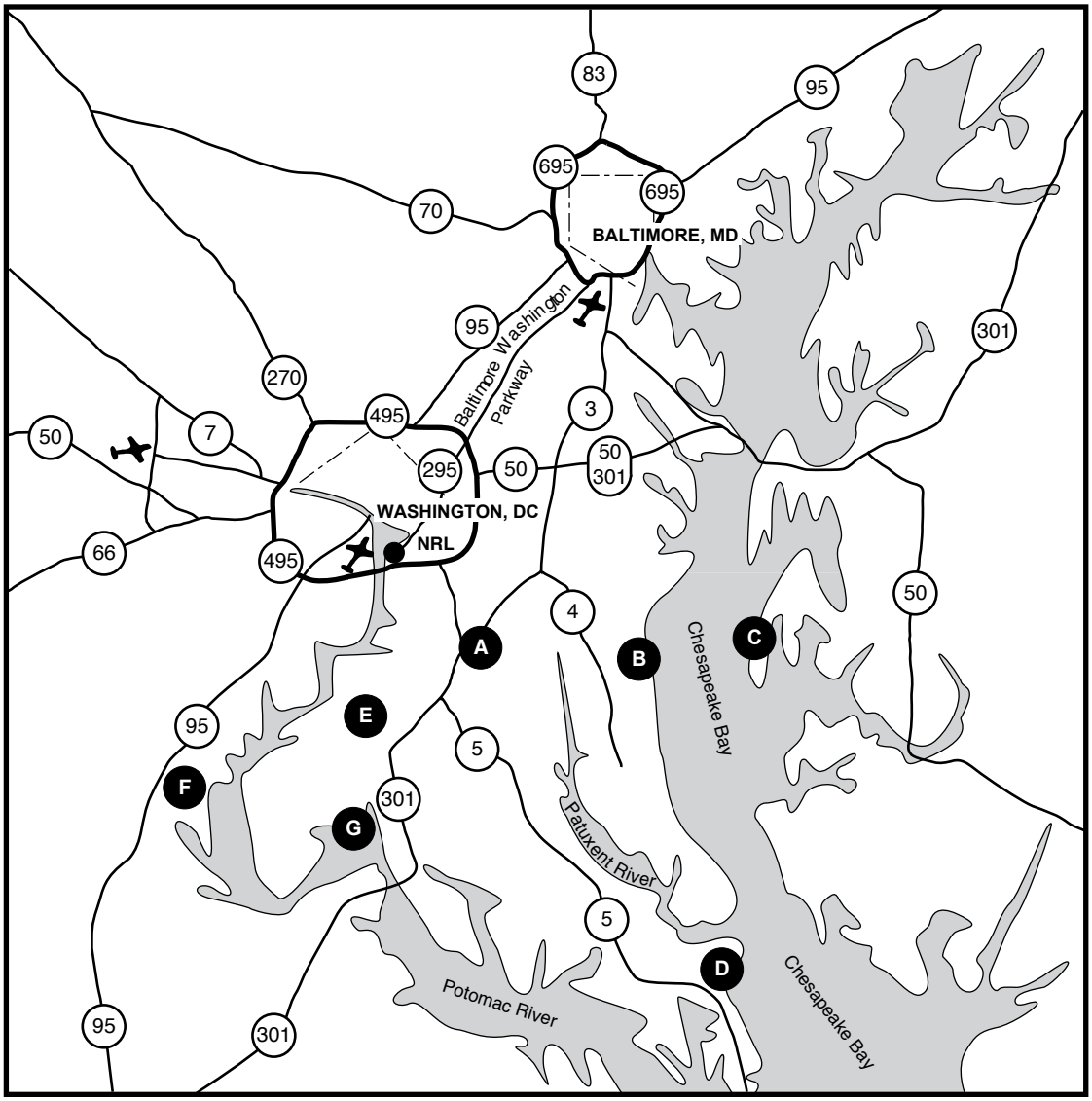
# General Information

# Naval Research Laboratory
# (Washington, DC)



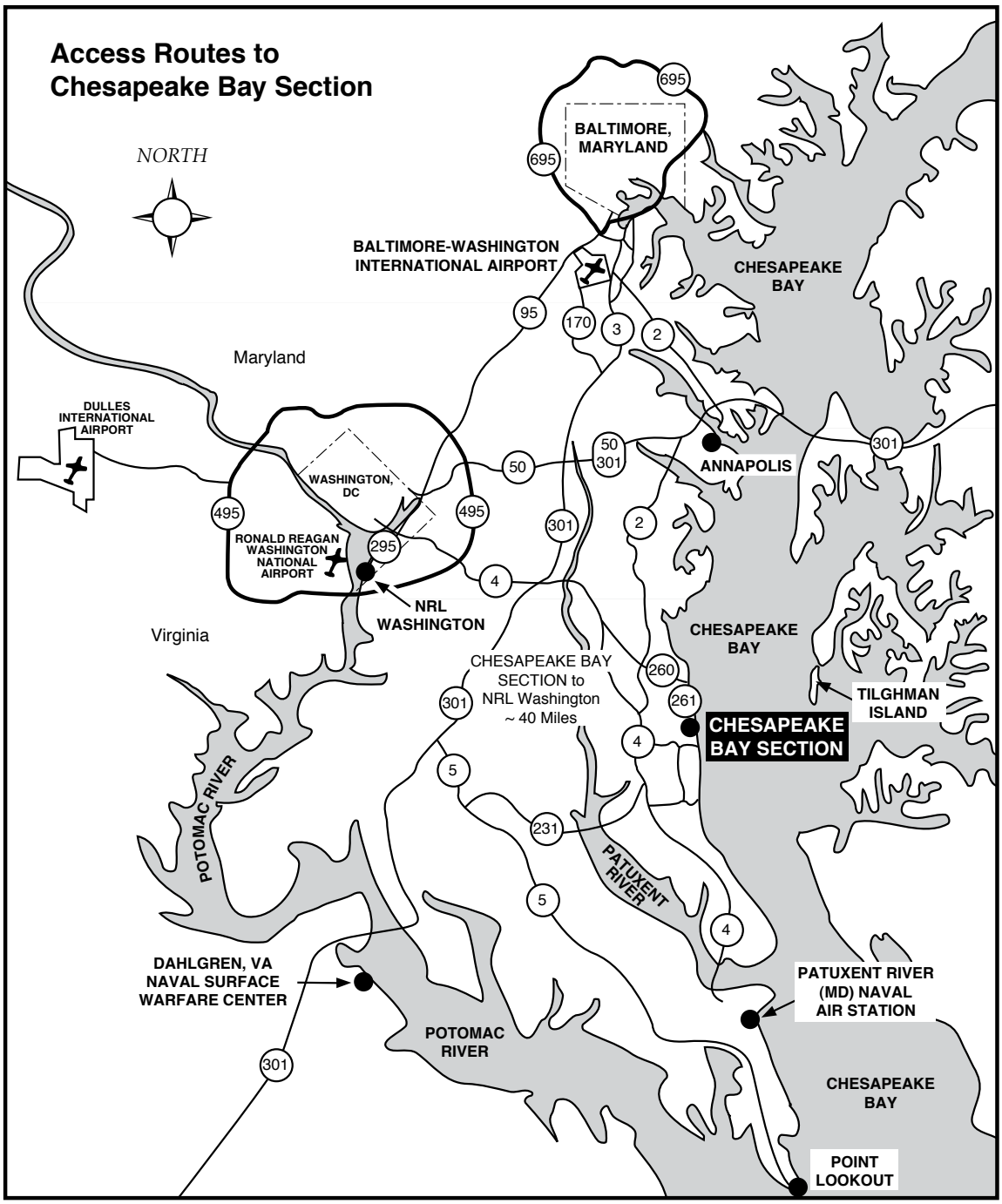

Naval Research Laboratory
4555 Overlook Avenue, SW
Washington, DC 20375-5320
(202) 767-3200 – DSN 297-3200

# Location of Field Sites in the NRL Washington Area



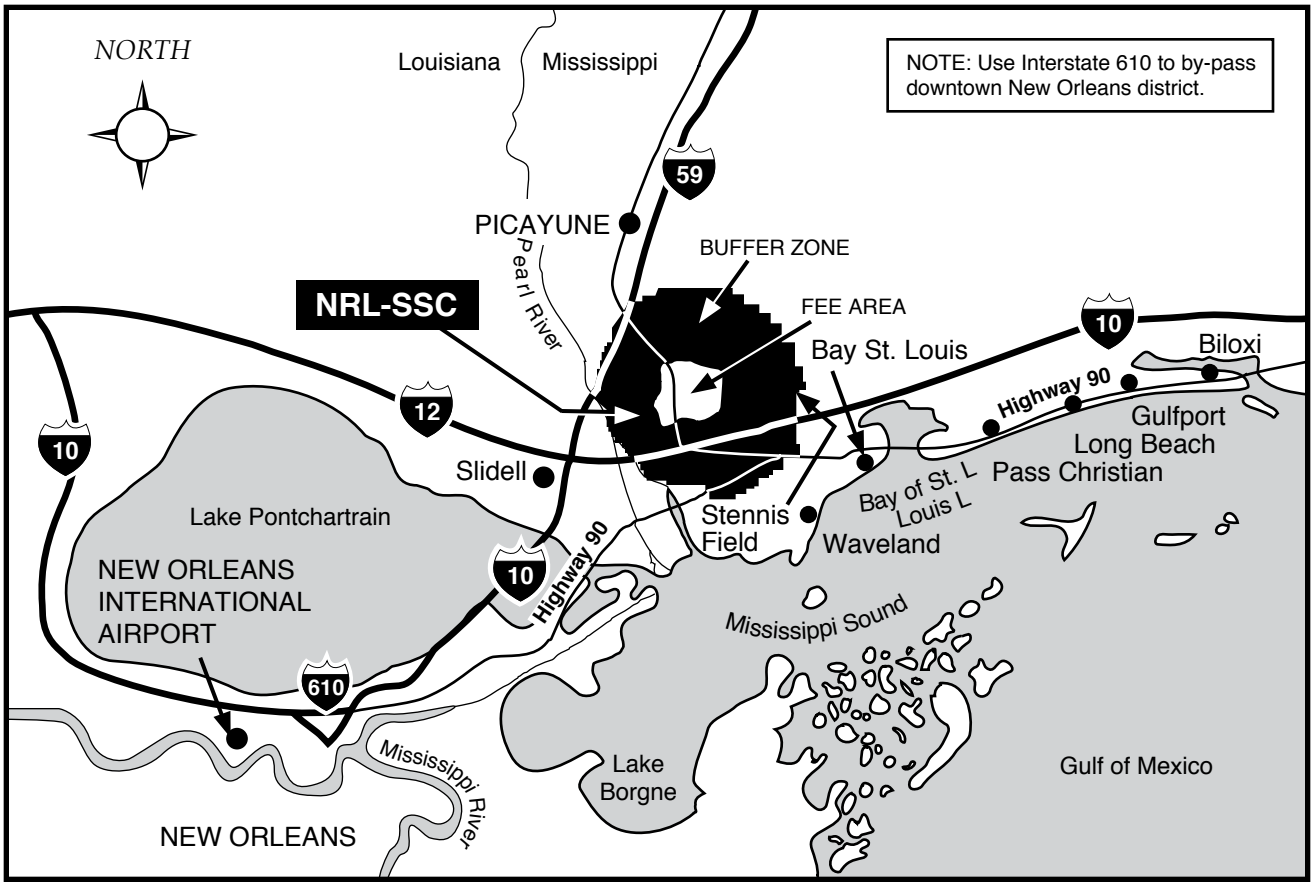

| | | Location | Approximate Mileage from NRL Washington | Cognizant Code |
|---|---|---|---|---|
| A | – | Brandywine, MD | 28 | 3520 |
| B | – | Chesapeake Bay Section, Chesapeake Beach, MD | 40 | 3522 |
| C | – | Tilghman Island, MD | 110 | 3522 |
| D | – | Patuxent River (MD) Naval Air Station | 64 | 1600 |
| E | – | Pomonkey, MD | 20 | 8124 |
| F | – | Midway Research Center, Quantico, VA | 38 | 8140 |
| G | – | Blossom Point, MD | 40 | 8140 |

# Chesapeake Bay Section
# (Chesapeake Beach, Maryland)



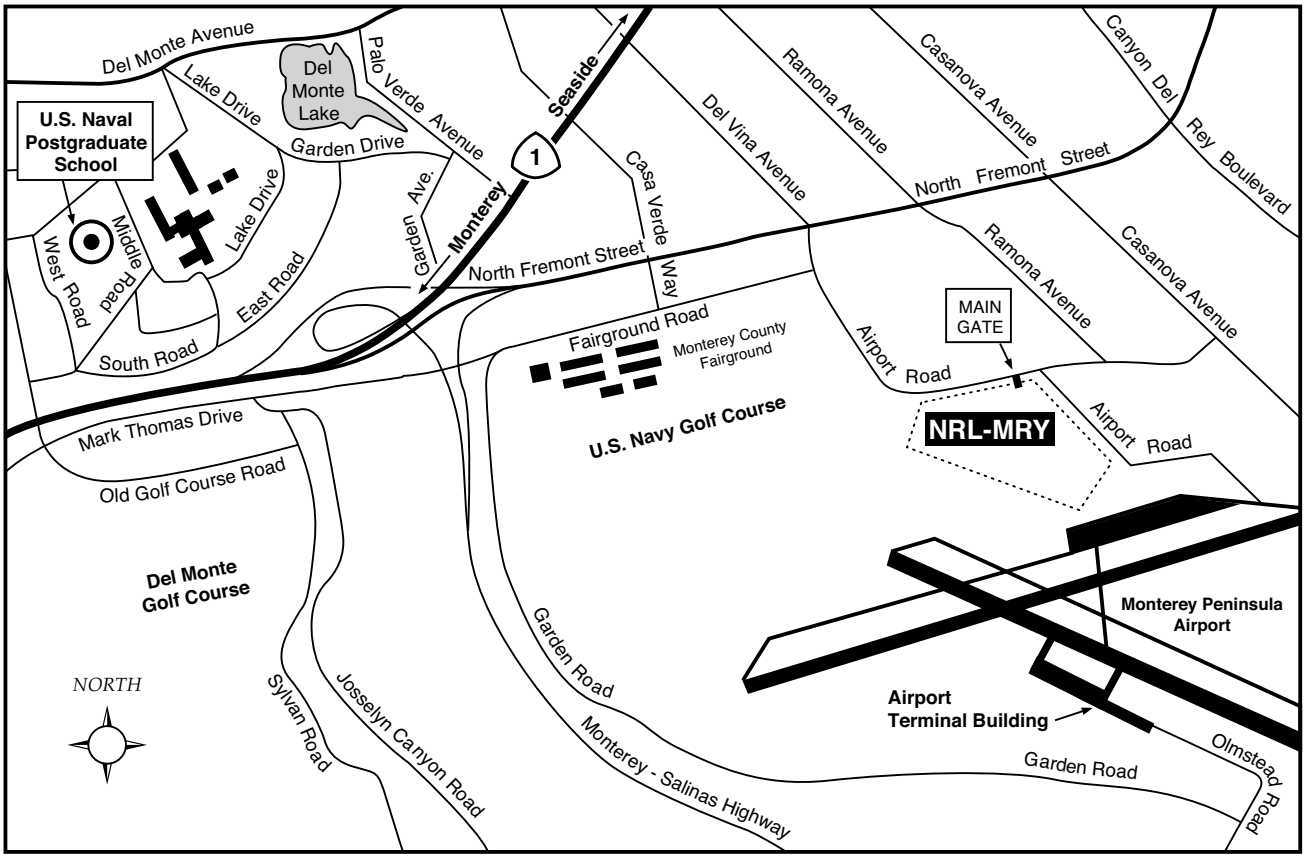

Naval Research Laboratory
Chesapeake Bay Section
5813 Bayside Road
Chesapeake Beach, MD 20732
(301) 257-4002

# John C. Stennis Space Center
# (Stennis Space Center, Mississippi)




Naval Research Laboratory
John C. Stennis Space Center
Stennis Space Center, MS 39529-5004
(228) 688-3390

# Naval Research Laboratory Monterey
# (Monterey, California)




Naval Research Laboratory
Marine Meterology Division
7 Grace Hopper Avenue
Monterey, CA 93943-5502
(831) 656-4721

# Key Personnel

**DSN: NRL Washington 297- or 754-; NRL/SSC 828-; NRL/Monterey 878-; NRL FSD/Patuxent River 342-**

| Code | | Telephone |
|---|---|---|
| | **EXECUTIVE DIRECTORATE** | |
| 1000 | Commanding Officer | (202) 767-3403 |
| 1000.1 | Inspector General | (202) 767-3621 |
| 1001 | Director of Research | (202) 767-3301 |
| 1001.1 | Executive Assistant | (202) 767-2445 |
| 1001.2 | Head, Strategic Workforce Planning | (202) 767-3421 |
| 1001.3 | Executive Assistant for Technology Deployment | (202) 767-0851 |
| 1002 | Chief Staff Officer | (202) 767-3621 |
| 1003 | Administrative Resources Manager | (202) 767-3091 |
| 1004 | Head, Office of Technology Transfer | (202) 767-3083 |
| 1006 | Head, Office of Program Administration and Policy Development | (202) 767-1312 |
| 1008 | Head, Office of Counsel | (202) 767-2244 |
| 1030 | Head, Public Affairs Branch | (202) 767-2541 |
| 1100 | Director, Institute for Nanoscience | (202) 767-1803 |
| 1200 | Head, Command Support Division | (202) 767-3091 |
| 1220 | Head, Security Branch | (202) 767-0793 |
| 1400 | Head, Military Support Division | (202) 767-2273 |
| 1600 | Commanding Officer, Scientific Development Squadron One (PAX River NAS) | (301) 342-3751 |
| 1800 | Director, Human Resources Office | (202) 767-8322 |
| 1830 | Deputy Equal Employment Opportunity Officer | (202) 767-8390 |
| 3005 | Deputy for Small Business | (202) 767-0666 |
| 3540 | Head, Safety Branch | (202) 767-2232 |
| | **BUSINESS OPERATIONS DIRECTORATE** | |
| 3000 | Associate Director of Research for Business Operations | (202) 767-2371 |
| 3005 | Deputy for Small Business | (202) 767-0666 |
| 3030 | Head, Management Information Systems Office | (202) 404-3659 |
| 3200 | Head, Contracting Division | (202) 767-5227 |
| 3300 | Head, Financial Management Division | (202) 767-3405 |
| 3400 | Head, Supply and Information Services Division | (202) 767-3446 |
| 3500 | Director, Research and Development Services Division | (202) 404-4054 |
| | **SYSTEMS DIRECTORATE** | |
| 5000 | Associate Director of Research for Systems | (202) 767-3525 |
| 5007 | Consultant | (202) 404-4004 |
| 5300 | Superintendent, Radar Division | (202) 404-2700 |
| 5500 | Superintendent, Information Technology Division/NRL Chief Information Officer* | (202) 767-2903 |
| 5600 | Superintendent, Optical Sciences Division | (202) 767-3171 |
| 5700 | Superintendent, Tactical Electronic Warfare Division | (202) 767-6278 |
| | **MATERIALS SCIENCE AND COMPONENT TECHNOLOGY DIRECTORATE** | |
| 6000 | Associate Director of Research for Materials Science and Component Technology | (202) 767-3566 |
| 6100 | Superintendent, Chemistry Division | (202) 767-3026 |
| 6300 | Superintendent, Materials Science and Technology Division | (202) 767-2926 |
| 6400 | Chief Scientist and Director, Laboratory for Computational Physics and Fluid Dynamics | (202) 767-3055 |
| 6700 | Superintendent, Plasma Physics Division | (202) 767-2723 |
| 6800 | Superintendent, Electronics Science and Technology Division | (202) 767-3693 |
| 6900 | Director, Center for Bio/Molecular Science and Engineering | (202) 404-6000 |

*Additional duty

**DSN: NRL Washington 297- or 754-; NRL/SSC 828-; NRL/Monterey 878-; NRL FSD/Patuxent River 342-**

| Code | | Telephone |
|---|---|---|
| **OCEAN AND ATMOSPHERIC SCIENCE AND TECHNOLOGY DIRECTORATE** | | |
| 7000 | Associate Director of Research for Ocean and Atmospheric Science and Technology | (202) 404-8690 |
| 7005 | Military Deputy | (202) 404-8162 |
| 7030 | Head, Office of Research Support Services | (228) 688-4010 |
| 7100 | Superintendent, Acoustics Division | (202) 767-3482 |
| 7105 | Naval Science (Acoustics) Research Coordinator | (202) 767-3643 |
| 7200 | Superintendent, Remote Sensing Division | (202) 767-3391 |
| 7205 | Military Deputy | (202) 767-4132 |
| 7300 | Superintendent, Oceanography Division | (228) 688-4670 |
| 7305 | Military Deputy | (228) 688-4013 |
| 7400 | Superintendent, Marine Geosciences Division | (228) 688-4650 |
| 7405 | Military Deputy | (228) 688-5404 |
| 7500 | Superintendent, Marine Meteorology Division | (831) 656-4721 |
| 7505 | Military Deputy | (831) 656-4782 |
| 7600 | Superintendent, Space Science Division | (202) 767-6343 |
| 7603 | Space Test Program Officer | (505) 846-8704 |
| **NAVAL CENTER FOR SPACE TECHNOLOGY** | | |
| 8000 | Director, Naval Center for Space Technology | (202) 767-6547 |
| 8100 | Superintendent, Space Systems Development Department | (202) 767-4593 |
| 8200 | Superintendent, Spacecraft Engineering Department | (202) 404-3727 |

## Technical Information Services Branch Production Staff


Editorial Assistance
*Claire Peachey*

Coordination, Design, and Layout
*Jonna Atkinson*

Photography
*Gayle R. Fullerton, James Marshall, Jamie Baker, and Jon Smallwood*

The cooperation and assistance of others on the staffs of the Technical Information Services Branch and the Central Mail Processing Unit are also acknowledged and appreciated.

REVIEWED AND APPROVED
NRL/PU/3430--10-532
RN: 10-1226-0023
February 2010

Paul C. Stewart, Captain, USN
Commanding Officer

http://www.nrl.navy.mil

# NRL FACT BOOK